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Bureau of Plant Industry, Soils, and Agricultural Engineering
and
PRODUCTION AND MARKETING ADMINISTRATION

(NOT FOR PUBLICATION)

MILLING, BAKING, AND CHEMICAL EXPERIMENTS WITH HARD RED SPRING WHEAT

1949 CROP 1/

by

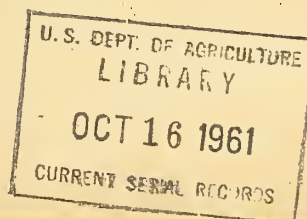
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- 1/ Cooperative investigations of the Division of Cereal Crops and Diseases, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration and the Grain Branch, Production and Marketing Administration. The samples were obtained from the cooperative experiments with the State Agricultural Experiment Stations in the spring wheat region.
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INTRODUCTION

Samples of the standard varieties and some of the new hybrid strains of hard red spring wheat, grown in cooperative experiments in the spring-wheat region 2/ of the United States, are milled each year by the United States Department of Agriculture and the flour baked into bread to determine their quality characteristics.

The baking methods and techniques used on the 1949 crop were essentially the same as used in testing the wheat varieties and hybrid strains for the 1944 to 1948 crops inclusive. The bread-baking tests included one method that has been used also for the 1939 to 1943 crops inclusive, which is the No. 6 baking test in the reports for these years.

The purpose of this report is to make available to cooperators the quality data from the 1949 crop obtained from standard varieties, new hybrid strains, and Federal supervision grade samples of hard red spring wheat, together with a summary of previous years' results.

SOURCE OF SAMPLES

Extensive tests were made on Eastern and Western composite samples of each of seven uniform varieties and of many additional varieties and strains grown in plot experiments at cooperating stations. These included samples grown at Madison, Wis.; St. Paul, Rosemont, Morris, and Crookston, Minn.; Fargo, Langdon, Edgeley, Williston, Minot, Mandan, and Dickinson, N. Dak.; Brookings, Eureka, Highmore, and Newell, S. Dak.; Moccasin, Mont.; Sheridan, Wyo.; and Akron, Colo. Similar tests were made on Eastern and Western composites of the 26 strains grown in the Uniform Regional Nurseries; on the wheats in the North Dakota and Montana Intrastate Nurseries; and those from station nurseries grown at Madison, Wis.; Brookings, S. Dak.; Langdon, Mandan, and Dickinson, N. Dak.; and Moccasin, Mont.

There were also included 17 samples composited from samples of carlot receipts of wheat accumulated during a 90-day period of the 1949 crop movement by the Minneapolis, Duluth, Denver, and Great Falls offices of the Grain Branch, Production and Marketing Administration. These samples represent country-run receipts of the class Hard Red Spring wheat and included only those that were graded No. 3 or better under the provisions of the U. S. Grain Standards Act. These are hereafter referred to as commercial samples. This is the eleventh season that such samples have been collected and tested.

METHODS USED IN THE MILLING AND BAKING TESTS

After the removal of dockage the samples were prepared for milling by use of a milling separator and a scourer (both machines of experimental or laboratory size). The wheats were tempered in two stages; first to 14 percent of moisture for 48 hours and then additional amounts of water added 1/2 hour previous to milling, raising the moisture content of the grain to between 15.0 and 16.5 percent depending upon the hardness of the variety. The wheat was milled on an Allis-Chalmers experimental flour mill provided with three break rolls and one smooth roll. A 90 percent patent flour was made, and the low grade flour was discarded.

2/ Clark, J. A. Results of spring wheat varieties grown in cooperative plot and nursery experiments in the spring-wheat region in 1949, with averages for 1938 to 1949. U.S. Dept. Agr. Res. Admin., B.P.I.S.2A.E., Div. Cereal Crops & Dis. 160 CC, 48 pp. March 1950. (Processed.)

The test weight per bushel of each sample was determined in the laboratory on the dockage-free wheat. The protein and ash contents are reported on a 14.0 percent moisture basis and the flour yield on a moisture-free basis.

The hardness of the grain was determined by pearling 20 grams of dockage-free whole wheat for 1 minute in a model No. 38 Strong-Scott Pearler. The amount of material pearled off expressed as a percentage of the wheat is called the pearling index. This pearling index has been found useful not only as a guide in tempering the samples for milling, but also as a measure of the vitreous character of the grain. A low index figure indicates hard grain and a high index figure indicates soft grain.

The bread-baking tests on the 1949 samples (same as used on the 1944 to 1948 samples inclusive) were made by a rich formula with none or varying amounts of potassium bromate added.

Details of the methods used in 1949, with the various ingredients, are shown in table 1.

Table 1. Baking method used for samples of the 1949 crop.

Ingredients and other items	Weight of ingredients, etc.
Flour (grams)	100.0
Yeast (grams)	2.0
Salt (grams)	1.5
Sugar (grams)	5.0
Potassium bromate (ngs.)	1, 2, 3, or 4
Malted wheat flour (grams)	.25
Nonfat dry milk solids (grams)	4.0
Shortening (grams)	3.0
Water absorption (percent)	Optimum for each variety
Mixing time (minutes)	Optimum for each variety
Fermentation time (minutes)	180
Handling of dough	1st. punch after 105 minutes 2nd. punch after additional 50 minutes Mold after additional 25 minutes Proofing time - 55 minutes Baked 25 minutes at 450°F.

This baking procedure is based on the method of the American Association of Cereal Chemists, with certain modifications deemed necessary for unbleached, experimentally-milled flour. Because of the size of the mixing bowl, ingredients sufficient for 2 loaves were mixed at one time. They were mixed a sufficient length of time to develop the dough properly in a Hobart-Swanson dough-mixer (108 R.P.M.) with 4 pins in the head and 2 pins in the bowl. The absorption of the flour was calculated from the amount of water added for proper consistency at the time the doughs were mixed. The absorption values are indicated in the tables. When mixed, the doughs were divided, then rounded in the hands, and placed in fermentation, granite-ware, "oatmeal" bowls, measuring 6 inches top diameter, 3 inches

from bottom diameter, and 2-1/2 inches deep. The punches were made by folding the dough approximately 10 times in the hands. At the end of the fermentation period the dough was molded by a Thompson mechanical roll type "A" moulder with rolls set at a clearance of 3/8 of an inch and the compression plate 1-1/8 inches. The molded doughs were placed in baking pans constructed from 2XX tin known as the tall form. The proofing time of 55 minutes, at 86° F. and baking time of 25 minutes at 450° F. were the same for all samples. Two loaves of each sample were baked, but since the ingredients were mixed as for one loaf, the two are not duplicates in the sense in which that term is usually used and are not so considered herein. Data given in the tables are averages of the two loaves.

The baking trials were made by varying the amounts of bromate (0 to 4 mg. per 100 grams of flour) with the formula given in table 1. With this baking procedure the maximum loaf volume is apparently obtained with the flour from each variety or strain. It has generally been found that the loaf having the maximum volume also has the best crumb color and grain texture of the different baking tests made. This test appears to bring out the full strength of the wheats somewhat better than the methods previously used. In actual practice a baking test with 1 milligram and another with 2 milligrams of bromate is made on the same day. Bakes with no bromate or increased amounts of bromate (3 milligrams or higher) are made on the following days until the maximum loaf volume has been attained for each variety or strain. Average volumes are calculated from the three best bakes only. This baking procedure brings each of the samples to its maximum volume by making provision for adequate gas production, by the employment of sufficient sugar diastatic supplements, and sufficient oxidation by the use of increasing amounts of potassium bromate.

A check or standard flour (12.6 percent protein and 0.48 percent ash and 14.0 percent moisture basis) was included in the baking trials with each day's tests. The average loaf volume of 76 baking tests made with the standard flour was 807 cc. and the standard error was 14.2 cc. On this basis the least significant difference between 2 single bakes is 40 cc.

EXPERIMENTAL RESULTS

The results for the regular methods on plot and nursery composite and station samples are given in tables 2 to 7, and for various baking methods on the six uniform varieties in table 8. The results for the commercial samples are shown in table 9, and the correlation and regression coefficients for 10 varieties and strains are shown in table 10. Summaries of the comparable 1949 samples are averaged in table 11, and 12-year results in table 12. These tables are largely self-explanatory. The varieties or strains are arranged in the tables in order of their maximum loaf volume. The highest ranking variety or strain with respect to each property is indicated by underlining. Acre yields are included, where comparable, to assist in the interpretation of results.

Many varieties and selections from hybrids tested during recent years represent some of the newer material developed by plant breeders. In view of the general interest in them it seems desirable to present the data relating to them although the number of comparisons available for most of the selections is too small to allow very definite conclusions to be drawn. Based on these results, however, new wheats are advanced from station nurseries to the Intrastate and Regional nurseries and

Table 2.--Yield, milling, baking, and chemical results on the uniform varieties of hard red spring wheat grown at experiment stations, from the Eastern and Western composites of the 1949 crop and averages for the 1948 and 1949 years.

Variety or Cross	State or N. No.	C. I. No.	Acre Yield Bu.	Test Weight Lbs.	Pearl- ing Index Value	Protein		Flour		Ab- sorp- tion Time	Baking Methods and Volume			Average		Grain tex- ture Score		
						Wheat		Flour	Yield		Ash	No. 6	Aver. 3 best	Opt- imum Bromate	Opt- imum Mg.		Weigh- of Loaf	Crumb Color
						Pct.	Pct.											
Eastern Composite 1/																		
Cadet		12053	18.3	54.8	23.8	14.5	13.7	73.1	.50	65	971	927	971	1	150	83	93	
Thatcher		10003	18.1	55.4	23.0	14.5	13.7	72.9	.50	64	909	901	954	0	144	72	87	
Lee		12488	24.9	58.3	28.1	15.3	14.4	72.1	.51	65	931	905	943	0	148	85	90	
Mida x Cadet	1831	12363	21.9	57.4	24.3	13.6	12.9	75.4	.53	63	931	893	931	1	149	80	88	
Rival		11708	22.5	57.4	25.1	13.5	12.8	74.7	.52	64	850	839	876	0	150	80	88	
Mida		12008	22.6	58.0	26.6	14.1	13.0	75.0	.52	64	869	846	869	1	151	82	90	
Average			21.4	56.9	25.2	14.3	13.8	73.9	.51	64	910	885	924	.5	149	80	89	
Range			6.8	3.5	5.1	1.8	1.6	3.3	.03	2	121	88	102	1	7	13	6	
Western Composite 2/																		
Thatcher		10003	19.7	57.7	26.7	15.8	15.4	71.5	.50	66	969	957	1030	0	150	77	85	
Pilot		11945	20.3	57.6	24.9	15.0	14.1	72.0	.44	64	865	869	945	0	150	80	85	
Cadet		12053	19.8	56.8	26.0	15.2	14.8	72.7	.51	68	936	910	939	0	150	83	90	
Mida x Cadet	1831	12363	20.3	59.0	27.3	14.6	14.0	76.7	.48	65	912	892	922	0	150	78	88	
Lee		12488	21.8	58.5	32.6	15.9	15.1	73.6	.45	65	896	891	917	0	150	87	90	
Mida		12008	20.6	59.6	29.7	15.2	14.2	75.1	.43	65	881	850	885	0	152	85	88	
Average			20.4	58.2	27.9	15.0	14.6	73.6	.47	66	910	895	940	0	150	82	88	
Range			2.1	2.8	7.7	1.3	1.4	5.2	.08	4	104	107	145	0	2	10	5	
Average of Eastern and Western composites																		
Thatcher		10003	18.9	56.6	24.9	15.2	14.6	72.2	.50	65	939	929	992	0.0	147	75	86	
Cadet		12053	19.1	55.8	24.9	14.9	14.3	72.9	.51	67	954	919	954	0.5	150	83	92	
Lee		12488	23.4	58.4	30.4	15.6	14.8	72.9	.48	65	914	898	930	0.0	149	87	90	
Mida x Cadet	1831	12363	21.1	58.2	25.8	14.1	13.5	76.1	.51	64	922	895	922	0.5	150	79	88	
Mida		12008	21.6	58.8	28.2	14.7	13.6	75.1	.48	65	875	848	876	0.5	152	84	89	
Average			20.8	57.6	26.8	14.9	14.2	73.8	.50	65	921	898	935	0.3	150	82	89	
Range			4.5	3.0	5.5	1.5	1.3	3.9	.03	3	79	81	116	0.5	5	9	6	

1/ From the Madison, Waseca, Morris, Crookston, Langdon, Fargo and Brookings stations.

2/ From the Mandan, Dickinson, Minot, Williston, Havre, Moccasin, Sheridan, Alliance, and Akron stations.

Table 2.--Continued

Section and Variety	Acre Yield		Test weight Lbs.	Pearl- ing index	Protein		Flour		Ab- sorp- tion time	Mix- ing time	Opt bromate	Baking Methods and volume			Average			
	Region	Compos- ite			Wheat	Flour	Yield	Ash				No. 6	Aver.	Cc.	Opti- mum	Weight of loaf	Color of crumb	Score
Average for 2 years, 1948 and 1949																		
Eastern Composite																		
Cadet	21.2	23.2	56.7	26.5	14.5	13.9	72.8	.52	68	2.5	1.0	961	905	961	961	152	83	91
Lee	25.0	27.1	59.0	29.8	15.2	14.5	73.6	.56	66	2.5	0.5	937	907	937	943	150	86	89
N. No. 1831	23.8	26.4	58.0	27.1	13.7	13.1	75.7	.54	65	2.3	1.5	924	904	924	926	151	80	87
Thatcher	22.1	23.8	57.2	25.6	14.6	14.0	73.3	.55	66	2.8	0.5	893	881	893	915	148	73	87
Mida	23.1	25.2	59.2	29.7	14.3	13.5	75.0	.53	66	2.3	1.0	890	864	890	890	153	83	89
Rival	23.7	26.0	58.3	28.1	13.9	13.4	74.8	.57	67	2.5	1.0	859	854	859	882	152	81	88
Average	23.2	25.3	58.2	27.8	14.4	13.9	74.2	.54	66	2.5	0.9	911	886	911	920	152	81	88
Range	3.8	3.9	2.5	4.2	1.5	1.4	2.9	.05	3	0.5	0.5	102	53	102	79	5	10	4
Western Composite																		
Thatcher	28.9	23.0	58.3	28.4	15.7	15.4	72.1	.53	67	2.3	0.5	963	941	963	993	151	78	86
Cadet	27.7	22.9	57.7	27.1	15.1	14.8	73.1	.54	70	2.8	0.5	967	933	967	969	154	86	89
Pilot	29.1	23.6	57.9	26.4	15.2	14.3	71.7	.49	67	2.3	0.5	929	914	929	939	151	80	84
Lee	29.4	24.4	59.0	32.2	15.9	15.3	73.0	.49	67	2.3	0.5	929	915	929	940	151	86	87
N. No. 1831	29.0	23.8	59.7	29.0	14.4	14.0	75.8	.49	67	2.3	1.0	907	891	907	919	152	79	86
Mida	29.1	23.5	60.2	30.6	15.2	14.5	74.4	.47	68	2.3	0.5	893	866	893	896	155	88	89
Average	28.9	23.5	58.8	29.0	15.1	14.7	73.3	.50	68	2.4	0.6	931	910	931	948	152	83	87
Range	1.7	.9	2.5	5.8	1.5	1.4	4.1	.07	3	0.5	0.5	74	75	74	97	4	10	5
Average of Eastern and Western Composites																		
Cadet	24.5	23.1	57.2	26.8	14.8	14.4	73.0	.54	69	2.7	0.8	964	920	964	964	153	85	90
Thatcher	25.5	23.4	57.8	27.0	15.2	14.7	72.7	.54	67	2.6	0.5	928	911	928	954	149	76	87
Lee	27.3	25.8	59.0	31.0	15.6	14.9	73.3	.53	67	2.4	0.5	934	911	934	947	151	87	88
N. No. 1831	26.4	25.1	59.2	28.1	14.1	13.6	75.7	.52	66	2.2	1.3	915	899	915	920	152	80	86
Mida	26.1	24.4	59.7	30.2	14.8	14.0	74.7	.50	67	2.3	0.8	892	865	892	892	154	86	89
Average	26.0	24.3	58.6	28.6	14.9	14.3	73.9	.53	67	2.4	0.8	927	901	927	935	154	83	88
Range	2.8	2.7	2.5	4.2	1.5	1.3	3.0	.04	.03	0.5	0.8	72	55	72	72	5	11	4

Table 3.—Yield, milling, and chemical results for the leading hard red spring wheats grown in replicated "plots" in 1949.

Madison, Wisconsin

Variety or Cross	State or N. No.	C. I. No.	Acres Yield Bu.	Test Weight Lbs.	Pearl- ing Index	Protein		Flour		Ab- sorp- tion Pct.	Mix- ing Time Min.	Baking Methods and Volume			Average			
						Wheat		Ash				No. 6	Aver. 3 best	Opt- imum Bromate	Weight of Loaf	Crumb Color	Grain Tex- ture	Score
						Pct.	Pct.	Pct.	Pct.									
Cadet		12053	13.8	45.9	25.7	17.7	17.0	68.0	.67	70	3.0	968	1067	1127	2	153	73	88
Regent		12070	17.1	51.5	30.1	17.1	15.9	70.7	.54	65	2.5	1105	1058	1105	1	149	75	87
Newthatch		12318	16.2	47.8	27.0	18.6	17.8	67.8	.71	67	2.5	1101	1071	1104	2	152	75	83
Pilot		11945	16.2	50.3	26.7	16.5	15.2	68.5	.58	65	3.0	1047	947	1047	1	149	72	88
Rushmore		12273	21.7	54.2	29.3	16.4	15.8	74.4	.62	66	3.0	1044	996	1044	1	151	87	90
Thatcher		10003	18.9	50.7	25.0	17.1	16.2	70.0	.61	65	2.5	1027	972	1027	1	149	72	88
Henry		12265	24.3	53.7	35.7	15.8	14.7	74.0	.54	63	2.5	1024	986	1024	1	150	70	85
Mida x Cadet	1831	12363	20.5	52.0	27.2	16.4	15.6	74.3	.62	65	3.0	1018	979	1018	1	150	72	88
H-196-21	W. 244	12617	20.3	52.2	31.0	17.0	15.9	70.2	.52	66	2.5	1018	959	1018	1	149	80	87
Rival		11708	18.3	52.5	28.5	15.6	14.8	72.1	.63	66	3.5	989	971	989	1	150	80	88
Pilot x Merit	1898	12442	17.2	50.8	22.4	16.6	15.4	65.9	.62	70	3.5	983	948	983	1	154	82	87
Sturgeon		11703	19.8	55.6	42.4	16.6	15.3	70.2	.55	64	2.5	980	925	980	1	150	78	88
H-195-45	W. 242	12484	20.4	52.4	32.4	16.1	15.0	70.6	.51	66	4.0	971	919	971	1	148	73	88
Lee		12488	25.4	55.4	30.0	17.1	16.0	70.3	.68	67	2.5	940	908	940	1	151	80	87
Pilot x Mida	M. 2776	12445	21.3	56.0	26.2	15.7	14.7	69.4	.52	66	2.5	937	893	937	1	149	78	88
Mida	1953	12008	18.6	54.0	27.8	16.3	15.4	72.9	.62	64	2.5	933	908	934	2	150	82	90
H-195-41	W. 246	12649	18.1	51.8	27.2	16.5	14.9	68.7	.53	63	2.0	934	898	934	1	148	75	87
Average			19.3	52.2	29.1	16.7	15.6	70.5	.59	66	2.8	1001	965	1011	1.2	150	77	87
Range			11.6	10.1	20.0	3.0	3.1	8.5	.20	7	2.0	172	178	171	1	6	17	7

Waseca, Minnesota

Timstein x Newthatch	M. 2797	12634	19.3	55.9	26.9	15.2	14.7	70.9	.65	66	2.0	897	1021	1041	4	152	80	87	
Lee	M. 2776	12488	21.8	58.0	29.6	14.7	13.6	73.5	.62	65	2.0	928	897	928	1	151	80	85	
Thatcher		10003	17.3	54.7	26.3	14.3	13.8	74.3	.65	64	2.0	902	859	902	1	147	70	85	
Pilot		11945	21.4	55.2	26.3	13.3	12.3	72.7	.54	62	2.0	900	861	900	1	149	87	87	
Cadet		12053	19.8	54.7	27.6	13.7	13.1	72.9	.58	64	2.0	873	887	898	2	150	87	92	
Rushmore		12273	21.9	56.5	31.7	13.7	13.2	75.5	.60	62	2.5	898	872	898	1	145	77	93	
Rival		11708	21.7	57.3	29.4	13.2	12.5	76.4	.67	66	2.5	898	879	898	1	151	83	88	
Mida		12008	18.1	58.4	30.2	13.5	12.7	75.1	.52	62	2.5	888	864	888	1	146	90	88	
Hope x Timstein	M. 2789	12546	25.2	50.0	27.3	14.3	14.0	75.2	.72	67	2.0	827	865	885	2	153	85	83	
Mida x Cadet	1831	12363	21.3	55.8	27.1	12.9	12.3	76.3	.55	60	2.5	882	847	882	1	146	83	87	
Pilot x Merit	1898	12442	23.1	56.5	21.4	13.2	12.3	71.9	.58	64	2.5	862	825	862	1	150	83	87	
Henry		12265	23.9	56.4	36.4	12.8	11.7	75.1	.48	58	2.5	836	834	859	2	146	77	88	
Hope x Timstein	M. 2796	12545	23.4	56.6	30.2	13.9	13.0	74.2	.61	63	2.0	845	838	848	2	148	83	87	
Pilot x Mida	1953	12445	23.6	58.3	27.5	12.5	11.4	73.9	.46	60	2.5	842	830	842	1	148	82	88	
Average			21.6	56.6	28.4	13.7	12.9	74.1	.59	63	2.3	877	869	895	1.5	149	82	88	
Range			7.9	3.7	15.0	2.7	3.3	5.4	.26	9	.5	101	196	199	3	8	20	10	

Table 3.—Continued

Morris, Minnesota

Variety or Cross	State or N. No.	C. I. No.	Bu.	Lbs.	Test Weight	Pearling Index		Protein		Flour		Ab- sorp- tion Time	Baking Methods and Volume				Average			
						Value	Wheat	Flour	Yield	Ash	Pct.		Pct.	No. 6	Aver. 3 best	Opti- mum	Opti- mum Bromate	Weight of Leaf	Crumb Color	Grain Tex- ture
Timstein x Newthatch	M. 2797	12634	27.0	54.7	26.8	16.8	16.0	70.8	.67	70	2.5	1033	1051	1090	2	150	72	80		
Cadet		12053	20.4	52.1	29.0	15.2	14.9	70.3	.50	63	2.5	1033	1023	1066	2	148	87	88		
Henry		12265	28.1	55.4	35.1	14.5	14.2	74.1	.49	62	2.5	956	988	1055	2	149	82	88		
Redman		12496	24.1	53.1	25.0	15.6	14.9	71.2	.56	67	3.5	951	978	1055	2	152	85	87		
Timstein x Mida	M. 2804	12771	26.5	54.0	30.1	15.7	14.7	75.4	.50	66	2.0	1033	969	1033	1	150	90	87		
Thatcher		10003	20.5	52.4	23.6	15.6	15.0	70.2	.50	64	3.0	1009	1003	1016	2	146	72	83		
Lee	M. 2776	12488	29.5	56.6	29.9	16.5	15.4	70.6	.51	65	2.5	974	932	974	1	150	87	87		
Rushmore		12273	26.3	56.4	31.5	14.6	13.9	75.4	.52	63	3.0	888	915	974	2	152	83	87		
Pilot x Merit	1898	12442	22.7	53.9	20.8	15.6	14.6	68.8	.54	67	3.0	951	935	968	2	151	80	87		
Mida x Cadet	1831	12363	25.4	56.7	27.4	14.5	13.6	74.5	.54	64	3.0	942	938	956	2	149	83	88		
Rival		11708	24.7	56.5	30.0	15.0	14.0	74.1	.51	67	3.0	945	932	953	2	153	87	88		
Pilot x Mida	1953	12445	27.8	58.3	26.1	14.2	13.4	72.4	.50	63	2.5	950	884	950	1	152	83	82		
Hope x Timstein	M. 2796	12545	31.4	55.5	28.5	15.7	14.8	72.4	.56	65	2.5	925	912	936	2	150	87	87		
Pilot		11945	22.0	54.0	23.4	15.3	14.3	71.4	.52	64	3.0	934	911	934	1	148	82	87		
Mida		12008	27.6	58.3	29.4	14.7	14.0	74.5	.54	64	2.5	922	882	922	1	150	88	85		
Timstein x Newthatch	M. 2807	12769	26.6	56.0	35.4	16.5	15.6	73.4	.63	64	2.0	911	845	911	1	154	75	82		
Hope x Timstein	M. 2789	12546	33.5	58.6	26.6	15.4	14.6	73.2	.54	69	2.0	873	865	896	2	154	87	82		
Timstein x Newthatch	M. 2808	12770	27.7	57.2	37.9	15.8	14.3	71.5	.60	62	2.0	894	854	894	1	147	78	85		
Timstein x Newthatch	M. 2805	12768	27.0	55.5	27.8	16.8	16.3	75.1	.66	67	2.0	833	853	876	2	154	76	82		
Timstein x Newthatch	M. 2806	12740	27.5	54.6	28.5	16.4	16.1	76.6	.64	66	2.0	827	791	827	1	153	82	82		
Average			26.3	55.5	28.6	15.5	14.7	72.8	.55	65	2.6	939	923	964	1.60	151	82	85		
Range			13.1	6.5	17.1	2.6	2.9	7.8	.18	8	1	206	260	263	1	8	18	6		

Table 3.--Continued

Crookston, Minnesota

Variety or Cross	State No.	C. I. No.	Acre Yield	Test Weight	Pearl- Index	Protein		Flour		Ab- sorp- tion	Baking Methods and Volume				Average			
						Wheat	Flour	Yield	Ash		Mix- ing Time	No. 6	Aver. 3 best	Cc.	Mg.	Grams	Crumb Color	Grain Tex- ture Score
Timstein x Newthatch	2797	12634	14.3	54.1	25.5	16.3	15.5	73.0	.47	68	2.5	1080	1111	1160	2	151	68	75
Lee	M. 2776	12488	21.4	56.1	32.7	16.4	16.2	75.3	.49	67	3.0	1038	1046	1075	2	150	82	82
Redman		12496	17.4	51.9	28.8	14.9	14.5	72.3	.50	65	2.5	1036	1023	1051	2	148	77	78
Hope x Timstein	M. 2796	12545	18.0	54.7	28.7	15.8	15.3	71.5	.49	67	3.0	1026	970	1026	1	151	83	87
Cadet		12053	14.4	53.4	24.5	14.8	14.2	72.7	.54	68	2.5	1024	983	1024	1	150	85	88
Pilot		11945	11.8	51.2	23.4	14.7	13.9	71.2	.53	64	2.0	1021	962	1021	1	147	75	87
Thatcher		10003	10.0	52.7	22.3	14.6	14.1	72.5	.51	66	2.5	983	941	983	1	147	70	87
Mida x Cadet	1831	12263	16.8	53.8	25.4	14.4	13.9	73.4	.50	64	2.0	962	939	962	1	149	78	88
2744 x 2809	Ns 3291	12741	22.0	56.4	31.4	14.1	13.5	76.2	.44	64	2.0	936	946	956	2	148	77	83
Henry		12265	13.7	54.0	28.7	14.0	13.0	73.3	.53	60	2.0	951	939	951	1	146	72	90
Rushmore		12273	15.3	56.6	26.8	13.8	13.3	73.9	.49	64	2.5	945	910	945	1	148	75	92
2744 x 2809	Ns 3274	12643	21.8	56.0	32.7	13.8	13.2	72.9	.41	64	2.0	939	899	939	1	149	77	85
Pilot x Merit	1898	12442	15.8	52.4	19.1	14.2	13.6	70.0	.55	68	2.5	916	905	919	0	151	77	87
Mida		12008	18.3	58.0	26.2	13.4	12.7	75.9	.52	65	2.0	856	840	874	0	149	75	85
Rival		11708	18.0	55.6	24.6	13.0	12.3	75.3	.52	65	2.5	847	840	865	0	148	80	90
Hope x Timstein	M. 2789	12546	24.8	57.7	24.3	14.2	13.5	74.9	.53	67	2.5	859	829	859	1	152	90	87
Pilot x Mida	1953	12445	19.0	57.0	24.2	12.9	12.1	73.0	.49	64	2.5	853	834	853	1	150	80	87
Average			17.2	54.7	26.4	14.4	13.8	73.4	.50	65	2.4	957	936	968	1.06	149	78	86
Range			14.8	6.8	10.4	3.5	4.1	6.2	.11	8	1.0	233	282	307	2	6	22	14

Table 3-- Continued

Fargo, North Dakota

Variety or Cross	State or N. No.	C. I. No.	Acre Yield Bu.	Test Weight Lbs.	Pearl- ing Index Value	Protein		Flour		Ab- sorp- tion Pct.	Mix- ing Time Min.	Baking Methods and Volume				Average		
						Wheat Pct.	Flour Pct.	Yield Pct.	Ash Pct.			No. 6 Cc.	Aver. 3 best Cc.	Opt- imum Cc.	Opt- imum Bromate Mg.	Weight of Loaf Grams	Crumb Color Score	Grain tex- ture Score
Cadet ²		12053	23.7	56.8	23.6	11.2	10.8	72.1	.64	69	3.5	778	749	778	1	153	85	88
Merit x Thatcher	2104	12540	27.6	61.1	23.0	11.0	10.2	73.3	.58	68	3.5	763	718	763	1	156	85	92
Lee	2776	12488	29.6	61.4	29.0	11.7	11.0	73.4	.56	69	3.5	747	719	747	1	154	82	85
Thatcher		10003	26.6	60.5	23.5	11.5	11.0	72.4	.57	67	3.0	741	712	741	1	154	77	82
2744 x 2809	3274	12643	27.6	60.3	29.1	11.4	10.7	74.6	.54	69	3.0	741	707	741	1	157	82	88
Pilot x Merit	1898	12442	28.9	59.6	22.9	10.9	10.1	73.3	.55	67	3.0	729	704	729	1	153	82	87
Am 10 x Newthatch	3685	12743	26.3	58.3	25.4	12.0	11.1	70.8	.55	70	3.5	727	713	727	1	156	77	87
Rival		11708	27.9	60.4	28.8	10.8	10.4	75.5	.60	70	3.5	709	693	726	0	158	80	85
Mida x Cadet	1831	12363	28.3	62.0	27.5	10.1	9.2	73.8	.54	64	2.5	721	692	721	1	154	73	87
Mida		12008	29.2	61.8	27.4	10.9	10.2	74.2	.52	64	3.0	715	661	715	1	154	80	82
2744 x 2809	3291	12741	28.7	60.7	29.3	11.3	10.6	75.5	.58	69	3.0	704	669	704	1	157	80	85
1552 x Mida	1924	12482	27.3	61.0	28.6	10.4	10.0	74.0	.55	62	3.0	698	679	698	1	150	75	82
1552 x Mida	2083	12543	29.8	60.7	30.2	10.4	9.5	73.3	.60	62	2.5	677	663	677	1	151	67	77
Pilot x Mida	1953	12445	30.1	61.6	28.3	10.3	9.5	74.5	.51	62	3.0	634	637	669	0	150	77	82

Average
Range

28.0	60.6	26.9	11.0	10.3	73.6	.56	67	3.1	720	694	724	.86	154	79	85	10
6.4	3.7	6.4	1.9	1.9	4.7	.13	8	1.0	144	112	109	1	8	3	10	10

Langdon, North Dakota

Rival		11708	22.2	62.3	26.4	14.3	13.6	75.7	.45	70	3.0	989	957	989	1	155	85	85
Thatcher		10003	13.5	61.5	24.9	13.7	13.0	74.8	.40	66	2.5	968	945	968	1	149	82	82
Pilot x Merit	1898	12442	18.2	62.1	23.2	14.1	13.3	74.4	.45	70	2.5	962	939	962	1	154	83	82
Mida x Cadet	1831	12363	17.3	61.9	24.9	14.0	13.1	75.7	.41	65	2.5	956	918	956	1	149	83	80
Redman		12496	15.7	61.3	28.2	13.4	12.8	74.9	.42	65	2.5	934	934	954	2	150	83	77
1691 x 1756	2105	12541	19.2	62.9	29.3	14.2	13.5	75.0	.42	64	2.5	953	915	953	1	150	83	83
Mida		12008	21.5	63.8	29.8	15.1	14.1	75.0	.39	68	2.0	914	911	940	C	154	88	82
Lee	M, 2776	12488	19.5	62.7	31.6	15.1	14.2	73.6	.39	70	3.0	933	926	933	1	154	95	83
Cadet		12053	18.2	60.8	23.0	14.4	13.4	73.1	.42	68	2.5	922	894	922	1	150	85	85
Pilot x Mida	1953	12445	26.3	64.4	26.0	14.4	13.3	74.3	.39	66	2.0	935	886	905	1	150	90	82
Pilot		11945	17.2	61.3	22.4	13.7	12.3	73.0	.42	64	1.5	903	872	905	0	152	85	82
1552 x Mida	2083	12543	21.0	63.1	28.3	13.6	12.5	74.4	.41	65	1.5	874	859	874	1	151	77	82

Average
Range

18.7	62.3	26.5	14.2	13.3	74.5	.41	67	2.3	934	913	938	.92	152	85	82	8
8.7	3.6	9.2	1.7	1.4	2.7	.06	6	2.5	115	98	115	2	6	13	8	

Edgeley North Dakota

Variety or Cross	Station		Acres Yield	Test Weight	Pearl- ing Index Value	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Baking Methods and Volume				Average		Grain Tex- ture
	N. No.	C. I. No.				Wheat	Flour	Yield	Ash			No. 6	Aver- age best	Opti- mum	Weight of Loaf	Crumb Color	Score	
Bu.		Pct.	Pct.	Pct.	Pct.	Cc.	Cc.	Mg.	Score	Score								
Thatcher Redman Lee M. 2776	1003	5.3	55.5	26.7	15.7	15.3	68.3	.46	68	2.5	1015	1032	1050	2	150	73	88	
	12496	4.4	53.1	33.2	15.7	15.4	70.7	.48	67	3.0	1050	1006	1050	1	150	78	87	
	12448	9.9	58.5	32.9	16.5	16.2	73.1	.47	68	3.0	1006	977	1006	1	150	87	87	
	12273	5.7	56.8	32.4	15.0	14.6	74.2	.45	64	3.5	1004	979	1004	1	149	82	90	
Spinkcota Henry Rival Mida	12375	7.3	61.3	39.7	16.4	15.7	73.2	.58	63	2.0	842	954	998	3	152	72	83	
	12265	6.4	58.0	37.4	14.4	13.9	74.2	.46	65	2.5	945	945	951	2	149	82	88	
	11708	7.2	58.9	30.0	14.2	13.6	73.9	.50	70	3.0	886	878	886	1	153	88	90	
	12008	7.4	58.0	29.8	14.5	14.1	73.0	.50	69	2.5	885	869	885	1	155	87	85	
Average Range		6.7	57.5	32.8	15.3	14.9	72.6	.49	67	2.8	954	955	979	1.50	151	81	87	
		5.5	8.2	13.0	2.3	2.6	5.9	.13	7	1.5	173	163	165	2.0	6	15	7	

Mandan, North Dakota

Thatcher		10003	26.6	57.0	35.6	17.1	16.5	74.2	.42	66	2.0	1010	998	1066	149	73	78
Pilot x Merit	1898	12444	29.1	56.3	27.0	16.6	16.1	71.5	.48	69	3.0	1053	981	1053	151	83	82
Redman		12638	27.0	55.2	35.7	15.6	15.5	73.7	.44	67	2.5	1027	994	1041	152	82	83
Rushmore		12273	30.0	57.2	38.4	16.2	15.7	72.8	.44	67	2.5	1041	968	1041	152	75	85
Pilot		11915	26.9	55.6	35.8	16.2	15.5	71.8	.41	64	2.5	1029	1019	1033	148	83	85
Pilot x Mida	1953	12445	30.7	60.0	38.3	15.9	15.0	70.7	.38	65	2.0	1001	946	1001	151	85	80
Leo	M. 2776	12488	30.2	57.1	37.5	17.1	16.6	73.1	.45	66	2.0	986	964	995	152	85	82
Pilot x Mida	1756	12303	29.6	58.9	37.7	15.6	15.2	73.0	.38	65	2.0	962	954	980	153	85	85
Mida		12008	29.1	59.6	38.4	16.7	16.1	73.0	.41	66	2.0	951	932	974	150	90	85
Rival		11708	27.7	57.3	30.2	16.2	15.5	73.6	.48	70	3.0	974	916	974	154	78	82
Mida x Cadet	1831	12363	29.6	58.4	34.5	15.0	14.5	77.0	.44	67	2.0	974	903	974	152	83	83
Cadet		12053	25.6	56.5	30.4	15.9	15.6	72.2	.44	68	3.0	956	907	956	153	83	80
Average			28.5	57.5	35.0	16.2	15.7	73.1	.43	67	2.4	997	957	1007	151	82	83
Range			5.1	4.8	11.4	2.1	2.0	6.3	1.0	6	1.0	102	116	110	6	17	7

Table 3. --Continued

Dickinson, North Dakota

Variety or Cross	State or N. No.	C. I. No.	Acres Yield	Test Weight	Pearl- Index Value	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Baking Methods and Volume			Average Weight of Leaf	Grain Tex- ture	Score	
						Wheat	Flour	Yield	Ash			No.	6 best	Opti- mum				Opti- mum Bromate
Rescue		12436	9.6	61.1	32.7	15.8	15.5	73.7	.44	66	2.5	1050	1050	1106	2	150	78	82
Rushmore		12373	9.8	61.0	33.0	16.7	16.3	75.4	.45	71	3.0	1101	1062	1101	1	150	85	82
Cadet		12053	13.0	59.3	26.5	16.6	16.2	70.9	.47	70	2.5	1004	1021	1064	2	154	77	82
Regent x Mida	1843-41	12542	12.3	62.0	29.6	16.4	16.3	74.1	.50	71	3.0	992	1011	1064	2	151	75	82
Pilot x Merit	1898	12442	10.3	60.1	25.0	16.8	16.2	72.4	.49	73	3.5	980	995	1050	2	153	87	82
Geres		6900	12.5	61.2	27.0	16.4	16.1	71.6	.47	70	2.5	1035	1012	1047	2	152	83	82
Redman		12495	8.9	59.8	30.7	16.5	16.0	73.5	.46	69	2.5	974	997	1044	2	154	87	82
Haynes Bluestem		2874	8.6	59.5	31.3	16.3	15.8	72.8	.47	67	2.0	913	1020	1041	3	153	78	87
Marquis		3641	10.9	61.5	29.1	16.1	15.3	71.0	.44	70	2.5	1018	1020	1026	2	155	85	83
Pilot		11945	13.6	59.8	26.1	16.3	15.5	72.1	.48	67	2.5	998	973	1010	2	152	82	87
Lee	M. 2776	12483	9.4	60.4	33.3	17.3	17.0	72.9	.48	68	2.0	980	990	1004	3	151	92	87
Thatcher		10003	17.0	60.7	30.6	17.0	16.6	72.8	.44	67	2.0	1004	980	1004	1	150	77	82
Mida x Cadet	1831	12363	10.6	62.0	28.3	15.9	15.3	74.8	.45	68	2.0	1001	968	1004	2	152	83	88
Pilot x Merit	2012	12493	11.4	60.2	25.0	17.0	16.3	71.0	.49	72	3.0	998	957	998	1	154	85	85
1552 x Mida	2083	12543	10.0	61.9	30.5	15.7	15.2	73.3	.48	68	2.0	865	967	992	3	154	78	87
Pilot x Mida	1953	12445	11.3	63.0	29.5	16.4	15.7	71.7	.42	70	2.5	983	960	983	1	151	88	85
Mida		12008	11.9	62.1	28.8	16.1	15.4	74.5	.44	69	2.5	971	948	980	2	154	87	85
Red Fife		3329	11.0	61.3	29.7	16.3	15.7	70.2	.45	67	2.5	965	970	977	2	152	83	87
1552 x Mida	1924	12482	11.1	61.5	30.6	15.9	15.5	75.0	.52	70	2.5	965	967	968	3	151	75	83
27-44 x 2809	Ns. 3274	12643	9.4	60.7	32.7	17.2	16.4	72.6	.44	70	2.5	965	951	965	1	152	90	87
Rival		11708	11.3	60.7	28.0	15.7	15.2	75.6	.48	69	3.0	953	937	953	1	153	88	90
1750 x 1753	2095	12551	9.7	61.8	25.5	16.7	16.0	71.3	.48	68	3.0	945	930	945	1	151	83	85

Average

Range

11.1	61.0	29.3	16.4	15.9	72.9	.47	69	2.5	985	986	1015	1.86	152	83	84
8.1	3.7	8.3	1.6	1.8	5.4	.10	7	1.5	236	132	161	2	5	17	8

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Table 3.--Continued

Minot, North Dakota

Variety or Cross	State of N. D.	C. I. No.	Acre Yield	Test Weight	Pearl- ing Index Value	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Baking Methods and Volume				Average			
						Wheat	Pct.	Pct.	Yield			Ash	No. 6	Aver. 3 best	Opti- mum	Opti- mum Bromate	Weight of Loaf	Crumb Color	Grain Tex- ture
Bu.																			
Redman		12496	1/	58.3	27.8	15.5	15.3	71.6	.57	70	2.0	998	1018	1047	2	153	82	85	
Henry		12385		59.0	30.6	15.6	15.0	74.5	.55	65	2.0	1033	952	1033	1	150	70	82	
Rescue		12436		59.5	29.6	14.9	14.9	74.2	.55	68	2.0	1024	976	1024	1	152	80	82	
That. x Apex	2176	12639		59.5	28.7	16.3	16.0	72.3	.58	68	2.0	1024	970	1024	1	150	77	85	
Ceres		6900		60.0	23.4	15.9	14.8	71.5	.54	74	2.5	1006	976	1006	1	151	78	83	
Pilot		11945		58.4	25.0	16.0	15.4	71.0	.52	69	2.5	995	973	995	1	152	80	85	
Pilot x Mida	1953	12445		61.7	26.6	16.3	15.7	70.3	.53	71	2.0	986	970	995	2	152	85	82	
Rival		11708		58.6	25.4	15.6	15.3	73.6	.60	71	2.5	986	957	986	1	150	77	85	
Pilot x Merit	1898	12442		58.3	22.7	16.7	16.2	70.9	.62	74	2.5	980	962	980	1	152	87	82	
2744 x 2809	3274	12643		57.3	28.1	17.8	17.7	71.3	.65	73	2.0	911	942	966	2	154	73	77	
Am ¹⁰ x Newthatch	3619			59.1	29.1	16.9	16.5	72.6	.59	70	2.0	965	937	965	1	154	87	88	
Thatcher		10003		59.1	24.6	15.6	15.3	72.4	.57	69	2.5	953	908	953	1	153	78	88	
Mida		12008		59.6	28.3	16.5	16.0	71.9	.54	67	2.0	951	923	951	1	149	87	87	
Cadet		12053		57.8	24.2	15.9	15.7	71.8	.63	73	2.0	945	928	945	1	152	77	85	
1552 x Mida	1924	12482		59.7	28.3	15.0	14.3	73.2	.55	69	2.0	919	930	943	2	150	82	87	
Lee	2776	12488		58.7	28.6	16.7	16.4	70.5	.63	70	2.0	922	884	922	1	154	80	83	
Mida x Cadet	1831	12363		59.4	26.6	15.6	15.2	73.2	.58	69	2.0	903	876	903	1	151	77	85	

Table 3.— Continued

Williston, North Dakota

Variety or Cross	State or N. No.	C. I. No.	Acre Yield	Test Weight	Pearl- ing Index Value	Protein		Flour		Mix- ing Time	Baking Methods and Volume				Average	
						Wheat	Flour	Yield	Ash		No. 5	Aver. 3 best	Opti- mum	Opti- mum Bromate	Weight of Loaf	Crumb Tex- ture Color
			Bu.	Lbs.	Pct.	Pct.	Pct.	Pct.	Pct.	Min.	Cc.	Cc.	Cc.	Mg.	Grains	Score
Rescue		12435	12.6	60.5	33.8	15.4	15.5	73.6	.49	2.5	1050	1039	1075	2	154	77
Pilot		11945	13.2	59.7	28.9	16.0	15.5	73.5	.47	2.0	1061	1030	1061	1	152	85
Rival		11708	12.9	59.7	29.2	15.7	15.5	76.5	.61	3.0	974	1007	1033	3	156	83
Vesta		11712	13.8	60.8	33.8	16.3	16.3	76.4	.53	3.5	1024	966	1024	1	158	92
Thatcher		10003	11.2	60.5	32.2	16.6	16.6	74.6	.53	2.5	1007	974	1007	1	152	75
Ceres		6900	14.3	60.8	26.9	15.6	15.3	73.0	.51	3.0	1001	947	1001	1	156	83
Cadet		12053	13.6	59.8	28.7	15.6	15.8	75.2	.54	3.0	950	975	992	2	156	77
Mida		12008	14.3	61.1	32.9	15.6	15.4	77.4	.53	2.0	954	971	986	2	153	87
Pilot x Mida	1953	12445	15.0	62.3	30.7	15.7	15.3	72.8	.42	2.5	985	957	986	1	156	88
Redman		12496	9.8	59.0	33.6	15.4	15.5	75.8	.50	3.0	959	969	983	2	155	80
Lee	2776	12488	12.5	60.1	33.7	16.3	16.1	72.6	.48	2.5	980	958	980	1	156	92
Mida x Cadet	1831	12363	14.0	61.0	29.4	14.8	14.7	75.9	.50	2.5	954	929	954	1	157	77
Average			13.1	60.4	31.2	15.8	15.6	74.8	.51	2.7	992	977	1007	1.5	155	83
Range			5.2	3.3	6.9	1.8	1.9	4.4	.19	1.5	107	110	121	2	6	15

Table 3.-- Continued

Brookings, South Dakota

Variety or Cross	State or N. No.	C. I. No.	Acre Yield	Test Weight	Pearl- ing Index	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Baking Methods and Volume			Average			
						Wheat		Yield				Ash		No. 6 wheat	Opti- mum Bromate	Weight of Loaf	Crumb Color	Grain Tex- ture
						Pct.	Pct.	Pct.	Pct.			Pct.	Pct.					
H.R.P. x Clarendon	SD 2202	12731	23.8	59.0	31.5	15.1	14.7	75.9	.49	62	2.0	1001	932	1001	1	148	83	83
Redman		12496	21.0	54.0	29.7	14.5	14.1	74.7	.61	63	2.5	974	947	992	2	150	83	85
Thatcher		10003	19.6	55.6	25.7	14.9	14.3	74.7	.69	64	2.5	983	935	983	1	149	72	85
H.R.R. x Merc.	SD 1691	12499	24.6	57.7	29.0	15.2	14.4	71.8	.58	64	2.0	945	896	945	1	151	77	83
Lee	M. 2776	12488	26.8	58.0	32.9	15.3	15.0	74.8	.67	66	2.5	940	901	940	1	154	90	88
Pilot		11945	22.0	56.5	23.6	14.8	14.0	71.0	.64	62	2.0	928	886	928	1	149	73	83
Mida x Cadet	1831	12363	23.4	57.0	26.9	13.7	13.1	75.7	.65	64	2.0	911	897	925	2	152	75	87
Cadet		12053	17.8	55.0	23.5	14.2	13.7	72.1	.70	65	2.5	911	901	920	2	154	75	88
Ceres		6900	22.2	58.0	24.1	14.3	13.7	74.8	.66	66	2.5	906	878	916	2	152	75	90
Pilot x Merit	1898	12442	21.9	55.8	21.8	14.8	14.1	72.4	.64	67	3.0	898	892	914	2	153	78	85
H.R. x Clarendon	SD 1091	12728	24.6	59.8	33.0	15.2	14.4	72.6	.61	60	1.5	830	827	839	0	149	87	87
Mida		12008	24.6	59.2	29.3	14.2	13.5	76.5	.62	62	2.0	892	854	892	1	152	87	92
Rival		11708	25.0	57.7	26.5	13.8	13.2	75.5	.76	65	2.5	882	855	883	2	152	77	87
Triunfo x Thatcher	SD 630	12625	26.1	60.3	38.9	14.8	13.5	74.3	.51	58	1.5	865	844	865	1	147	77	87
Thatcher x Triunfo	SD 139	12727	26.1	59.7	34.9	15.4	14.9	74.9	.55	60	1.0	871	832	871	1	148	88	87
Rushmore		12273	24.2	57.4	31.3	14.2	13.7	76.0	.62	62	2.5	839	824	862	2	148	77	87
Triunfo x Thatcher	SD 339	12627	24.0	59.5	40.6	14.5	13.2	72.7	.51	58	1.5	848	796	848	1	147	72	77
Thatcher x Triunfo	SD 343	12497	25.9	60.0	40.9	14.6	13.1	70.0	.47	58	1.5	827	781	827	1	148	77	82
Average			23.5	57.8	30.2	14.6	13.9	73.9	.61	63	2.1	903	871	908	1.33	150	79	86
Range			9.0	6.3	19.1	1.7	1.9	6.5	.25	9	2.0	174	166	174	2	7	18	15

Table 3. Continued

Highmore, South Dakota

Variety or cross	State or N. No.	C. I. No.	Acre yield	Test weight	Pearl- ing index value	Method & Volume										Average				
						Wheat		Flour		Flour Yield	Ash	Ab- sorp- tion	Mix- ing time	No. 6 best			Opti- mum	Opt. bro. weight	Grain color	tex.
						Pct.	Pct.	Pct.	Pct.					Cc.	Cc.	Cc.				
Lee		12488		59.6	31.4	15.0	14.4	73.2	.65	68	2.0	892	885	917	0	154	90	88		
Thatcher		10003		57.6	24.1	15.0	14.4	73.1	.68	65	2.5	894	874	906	2	148	77	90		
Cadet		12053		54.0	23.5	14.5	13.8	69.9	.70	66	2.5	804	843	865	2	151	82	90		
Rival		11708		58.5	26.5	14.4	13.5	73.4	.77	67	2.5	836	832	836	1	152	80	90		
Rushmore		12273		58.8	28.6	14.0	13.6	73.7	.60	69	3.5	818	817	836	0	156	72	85		
Ceres		6900		59.7	23.9	13.6	12.8	72.4	.67	68	3.0	806	795	806	1	154	78	88		
Mida		12008		60.1	27.2	13.9	12.8	72.6	.58	64	2.0	778	768	778	1	150	83	92		
Average				58.3	26.5	14.3	13.6	72.6	.66	67	2.6	833	831	849	1	152	80	89		
Range				6.1	7.9	1.4	1.6	3.8	.19	5	1.5	116	117	139	2	8	18	7		

Table 3.—Continued

Havre, Montana

Variety or Cross	State or N. No.	C. I. No.	Acre Yield	Bu.	Test Weight	Pearl- ing Index Value	Protein		Flour		Ab- sorp- tion Pct.	Mix- ing Time Min.	Baking Methods and Volume			Average	
							Wheat	Flour	Yield	Ash			No. 6	Aver. 3 best	Opti- mum Bromate	Opti- mum Loaf	Grain Tex- ture
Reward		8182	6.7	57.3	32.2	17.1	16.9	74.2	.47	66	2.5	1122	1129	1148	2	148	80 78
Marquis		3641	7.5	56.4	30.5	17.0	16.8	74.6	.52	69	2.5	1136	1093	1137	2	151	78 78
Ceres		6900	7.8	56.8	29.1	16.9	16.8	73.7	.49	69	2.5	1116	1080	1122	2	153	73 75
Merit x Pilot	1860	1235	6.7	55.7	26.1	16.8	16.7	73.9	.48	71	2.5	1066	1040	1109	2	154	75 77
Rescue		12435	6.7	55.8	32.7	16.7	16.9	74.2	.51	65	2.5	1064	1086	1104	2	151	73 75
Mida x Cadet	1831	12353	6.7	55.6	28.6	16.0	15.9	76.8	.50	68	2.5	1084	1057	1087	2	152	72 80
Pilot		11945	6.1	55.1	28.6	17.0	16.5	72.5	.49	67	2.5	1078	1070	1082	2	153	78 73
Cadet		12053	5.9	52.8	28.5	17.5	17.3	73.2	.58	72	2.5	1076	1036	1076	1	154	73 78
Thatcher		10003	6.9	55.6	29.6	16.7	16.6	75.4	.47	68	2.5	1058	1051	1067	2	150	72 75
Pilot x Mida	1756	12303	7.8	57.7	30.0	15.8	15.6	75.9	.47	65	2.5	1027	987	1027	1	149	82 78
Supreme		8026	7.5	54.7	30.3	16.1	16.0	75.1	.49	69	3.0	1027	978	1027	1	153	75 83
Lee	M. 2776	12488	7.2	56.8	35.0	16.9	16.8	74.2	.51	69	2.0	1003	948	1003	1	152	82 77
Pilot x Mida	1953	12445	8.9	59.5	28.8	15.2	15.0	77.5	.50	67	2.5	962	962	989	2	150	82 80
Mida		12008	6.7	57.8	29.7	15.4	15.1	75.9	.48	70	2.5	936	910	936	1	155	82 77

Average

Range

7.1

2.8

56.3

6.7

30.0

8.9

16.5

2.3

16.4

2.3

74.8

5.0

.50

.11

68

7

2.5

1.0

1054

200

1031

219

1065

212

1.64

1

152

7

77

10

Table 3 -- Continued

Sheridan, Wyoming

Variety or Cross	State or N. No.	C. I. No.	Acre Yield	Test Weight	Pearl- Index Value	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Baking Methods and Volume				Average	
						Wheat	Flour	Yield	Ash			No. 6	Aver- 3 best	Opt	Weight of Loaf	Crumb Color	Grain Tex- ture
			Bu.	Lbs.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Min.	Cc.	Cc.	Cc.	Mg.	Score	Score
Pilot ² x Thatcher	2030	12736	35.9	56.7	31.3	15.5	14.2	73.9	.47	64	1.5	989	994	1021	2	149	82
Pilot x Merit	1996	12648	38.2	57.4	34.1	15.5	14.3	73.1	.46	68	2.0	986	978	1004	2	151	77
1764 x 1753	2213	12738	38.5	57.0	34.4	15.7	14.5	71.2	.49	66	2.0	998	961	998	1	150	78
1552 x Mida	1924	12482	37.6	57.5	38.9	15.9	15.0	75.6	.51	67	2.0	933	937	980	2	152	82
Pilot x Mida	1785	12647	34.1	57.4	37.0	16.5	15.4	77.2	.51	63	1.5	908	938	968	2	151	85
Pilot ² x Merit	2174	12732	42.3	57.6	31.6	15.2	14.3	72.4	.56	70	2.0	966	934	966	1	153	82
Merit ² x Thatcher	2104	12540	33.9	56.4	30.9	16.4	15.0	70.1	.56	69	2.0	962	917	962	1	153	85
1764 x Henry	2211	12733	45.5	57.1	35.2	16.3	15.8	72.5	.49	67	1.5	954	909	954	1	152	85
Rushmore		12273	39.7	58.0	40.4	15.1	14.8	76.5	.55	66	2.0	948	932	948	1	150	87
Ceres		6900	39.1	59.2	33.8	15.6	15.1	75.5	.48	66	2.0	948	928	948	1	152	85
Pilot x Merit	2164	12735	39.9	57.0	27.3	15.0	14.2	71.9	.58	70	2.5	948	921	948	1	154	83
Thatcher		10003	39.1	57.0	30.5	16.4	16.1	73.6	.59	67	1.5	945	923	945	1	150	80
Marquis		3641	37.0	58.0	35.2	15.6	15.0	73.3	.53	67	1.5	937	934	937	1	151	85
Pilot x Merit	1898	12442	35.9	57.4	30.5	15.6	14.8	72.7	.53	69	2.0	937	922	937	1	153	87
Cadet		12053	38.8	56.2	33.5	15.8	15.4	74.2	.48	65	2.0	931	923	933	2	149	85
Pilot x Mida	1953	12445	38.5	59.5	36.8	15.0	14.4	74.6	.46	66	1.5	925	894	925	1	151	82
Mida		12008	35.6	57.7	39.7	15.7	15.0	75.8	.47	67	2.0	925	888	925	1	153	87
Pilot		11945	40.1	58.6	26.3	14.4	13.7	75.3	.50	66	2.0	894	891	919	0	152	85
Pilot x Mida	1756	12303	41.4	60.0	40.1	14.7	14.1	74.8	.44	64	1.5	889	879	889	1	150	83
1691 x 1756	2105	12541	36.4	58.1	40.8	15.9	14.3	73.8	.43	65	1.5	862	865	879	2	151	83
1750 x 1753	2095	12551	38.8	60.5	30.2	16.0	14.7	72.1	.50	68	1.5	853	858	879	0	152	83
1552 x Mida	2083	12543	40.8	59.5	41.1	15.0	14.3	74.9	.48	64	1.5	845	860	871	2	152	87
Mida x Cadet	1831	12363	39.4	59.8	35.4	14.9	14.3	76.8	.50	66	1.5	868	859	870	0	150	87
1750 x 1753	2093	12550	33.9	60.3	28.6	14.9	13.6	72.7	.56	66	1.5	851	806	851	1	151	83
1750 x 1753	2092	12549	41.1	58.4	36.2	15.4	14.2	73.6	.53	64	2.0	845	810	845	1	151	78
1691 x 1756	2035	12492	36.2	58.3	38.4	15.1	13.9	76.1	.47	63	1.5	836	831	836	1	149	82
Lee	12776	12188	39.7	56.5	45.3	16.1	15.7	73.8	.55	65	1.5	781	806	824	2	154	72
Average			38.4	58.0	34.9	15.5	14.7	74.0	.51	66	1.8	913	900	925	1.19	151	83
Range			11.6	4.3	19.0	2.1	2.5	7.1	.09	7	.5	217	188	197	2	5	16

Table 3. Continued

Akron, Colorado

Variety or cross	State or N. No.	C. I. No.	Acre yield	Test weight	Pearl- ing Index value	Protein		Flour Yield	Ab- sorp- tion	Mix- ing time	Method & Volume			Opt. bromate	Weight of loaf	Average		
						Wheat	Flour				No. 6	Aver. 3 best	Cc.			Cc.	Gr.	Score
Reward		8182	10.7	59.3	27.8	14.1	13.3	71.3	.50	64	3.0	928	878	928	1	149	83	90
Thatcher		10003	11.8	54.5	22.9	14.8	14.2	72.3	.53	66	3.0	891	853	910	2	150	75	83
Ceres X H.T.F.	1556	12263	13.0	56.4	27.7	13.5	12.7	72.5	.45	64	2.5	871	837	871	1	150	83	88
Cadet		12053	10.2	54.5	22.5	14.2	13.6	70.6	.49	67	3.0	836	802	856	2	152	82	87
Lee	M. 2776	12488	14.2	55.5	29.3	14.1	13.7	74.5	.60	65	3.0	848	830	848	1	153	83	88
1750 X 1753	2095	12551	12.9	56.6	21.0	14.6	13.7	71.2	.58	68	3.0	836	815	836	1	154	80	88
Pilot		11945	11.0	55.6	21.3	13.6	12.6	70.7	.47	64	3.0	824	811	824	1	151	77	88
Pilot X Mida	1953	12445	12.7	58.8	25.4	12.8	11.8	72.6	.46	63	2.5	792	763	792	1	151	88	88
Pilot X Merit	1898	12442	11.7	56.5	20.3	14.0	12.9	71.5	.53	67	3.5	772	770	781	0	154	83	85
Mida		12008	13.5	58.0	27.2	13.1	12.2	74.2	.47	65	2.5	769	731	778	2	153	78	83
1750 X 1753	2092	12549	12.5	58.0	25.8	13.1	12.2	72.5	.49	64	2.5	752	720	752	1	151	78	78
Pilot X Mida	1756	12303	12.9	58.5	25.0	12.9	12.2	73.1	.51	64	2.5	726	705	726	1	153	75	80
Average			11.4	56.9	24.7	13.7	12.9	72.3	.51	65	2.8	820	793	825	1.17	152	80	86
Range			11.3	4.8	9.0	2.0	2.4	3.9	.15	5	1.0	202	173	202	2	5	13	12

1/ Sown 8 days later than other varieties.

Table 4.--Yield, milling, baking and chemical results for newer hard red spring wheats grown in single increase plots in 1949.

Mandan, North Dakota

Variety or Cross	State or No.	C. I. No.	Acre Yield	Test Weight	Pearl- ing Index	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Baking Methods and Volume			Average					
						Wheat	Pct.	Pct.	Pct.			Pct.	No. 6	Aver. 3 best	Opti- mum	Opti- mum Bromate	Weight of Leaf	Crumb Color	Grain Tex- ture	Score
Bu.	Lbs.	Pct.	Pct.	Pct.	Pct.	Pct.	Min.	Cc.	Cc.	Mg.	Score	Score	Score							
1764 x Henry	2211	12733	37.2	58.0	37.0	16.4	15.9	69.8	.39	68	2.5	1039	1037	1095	2	152	77	87		
1750 x 1753	2115	12640	36.7	59.8	36.8	16.5	15.8	70.6	.37	68	3.0	1086	999	1086	1	150	82	87		
1750 x Timstein	2313	12778	39.0	59.1	46.8	17.0	16.6	69.9	.39	64	1.5	1041	1051	1084	2	150	87	83		
Regent x Pilot	1920		31.0	53.7	35.1	15.9	15.4	72.6	.41	65	3.0	1061	1008	1061	1	148	82	87		
Thatcher		10003	38.2	57.2	45.7	15.9	15.4	74.7	.43	65	2.5	977	992	1044	2	149	77	85		
1764 x Henry	2232	12637	39.8	56.1	36.3	14.7	14.4	72.0	.41	71	3.0	1012	1000	1030	2	153	75	83		
Marquis		3641	31.9	59.6	36.2	15.8	15.5	72.8	.48	66	2.5	1030	965	1030	1	150	78	88		
Pilot ² x Merit	2174	12732	35.1	58.6	28.8	15.2	14.5	72.1	.43	69	3.0	1018	975	1018	1	149	82	82		
Pilot ² x Thatcher	2030	12736	35.5	57.7	32.6	14.7	13.6	73.5	.39	65	2.5	953	960	1012	0	148	82	87		
1750 x 1753	2271		35.3	60.2	36.8	15.8	15.0	73.3	.41	69	3.0	1001	972	1001	1	150	80	83		
1750 x Timstein	2237	12734	37.2	59.2	46.4	15.5	14.7	71.7	.39	65	2.0	954	949	998	0	151	78	83		
1750 x 1753	2095	12551	32.7	60.8	33.1	15.0	15.1	72.3	.37	70	3.0	992	977	992	1	150	83	82		
1764 x Henry	2250		36.0	59.2	31.7	15.6	15.2	72.8	.48	72	3.0	953	943	980	2	154	78	88		
1750 x 1753	2092	12549	37.3	59.1	41.6	15.2	14.3	72.5	.38	65	2.0	957	915	957	1	150	83	87		
Henry x 1907	2242	12777	39.4	59.7	39.9	15.2	14.1	72.3	.39	63	2.0	948	911	948	1	149	87	88		
Henry x Cadet	2239	12779	41.1	58.7	38.6	15.5	14.9	73.1	.41	66	2.5	911	944	974	4	150	80	87		
Mida ²		12008	41.6	60.9	39.7	15.2	14.5	74.2	.42	66	2.5	925	894	925	1	150	90	93		
Pilot ² x Merit	2164	12735	39.4	59.0	35.5	14.0	13.3	73.9	.46	69	3.5	910	906	916	0	150	73	85		

Average	36.9	58.7	37.7	15.6	14.9	72.5	.41	67	2.6	987	967	1008	-1.28			150	80	86	
Range	10.6	7.2	15.1	3.0	3.3	4.9	.11	9	2.0	175	143	178	2			6	12	11	

then to plots. Possibly the most outstanding new strains tested for the first time in 1949 are Regent X Pilot N. No. 1920, 1764 X Henry N. No. 2250, 1759 X Tinstein N. No. 2313 and 1750 X 1753 N. Nos. 2115 and 2271 as shown in table 4 for the Mandan, North Dakota, increase plots, and Pilot X Merit N. N. 2137, Henry X Cadet N. No. 2233 and 1750 X Tinstein N. No. 2237 in table 7 for the Langdon Station Nursery. Outstanding strains such as these are advanced to Regional Nurseries and plot experiments.

UNIFORM REGIONAL NURSERY

Twenty-six wheats from the Uniform Regional Nursery have been tested in duplicate for their milling, baking, and chemical properties. An Eastern composite was composed of grain from eight stations and grain from six dry-land stations made up the Western composite. The grain from three Western irrigated stations was not included nor tested. The results of the quality tests for the Eastern and Western composites and the average of both are shown in table 6. The discussion which follows is based on the average of the Eastern and Western composites. Acre yields ranged from 17.0 bushels for Marquis to 25.6 bushels for Hope X Tinstein II-39-51.

The test weight per bushel of the samples were lower than in previous years. A number of the varieties and strains averaged lower than 57 pounds per bushel. These were Redman, Pilot² X Merit N. 2174, Thatcher X W38-Hope W246, Tinstein X Newthatch II-42-38, Am¹⁰ X Newthatch Ns. 3684 and 3685 and Regent X 1315 N. 1950. Redman was also one of the lower test weight per bushel in last year's nursery trials. Pilot X Mida N. 1953, Thatcher X Surpresa II-39-8, and Thatcher X Triunfo SD 343 averaged highest. These three strains were also best among the 1948 Regional Nursery samples.

The protein content averaged about the same as last year's nursery samples. A number of the varieties and strains averaged high in wheat protein. Those averaging above 16.0 percent were Tinstein X Newthatch II-42-38 and Am¹⁰ X Newthatch N. 3685. Those averaging lowest and about 14.0 percent in wheat protein were Pilot X Mida N. 1953, 1552 X Mida N. 1924.44, and Regent X 1315 N. 1950. It is important to note that a number of those higher protein wheats are among the best in acre yield. This is an exception to the general belief that high yields are usually associated with relatively low protein contents. The flour proteins averaged 0.8 percent lower than the wheat.

The flour yields varied over a wide range. A number of the strains yielded a high percent of flour, some exceeding others with higher test weight per bushel. Pilot X Mida N. 1953, 1552 X Mida N. 1924.44, Thatcher X Surpresa II-39-8, 2744 X 2809 Ns. 3274 and 3291 were highest in flour yield. N. No. 1953 and Ns. 3274 were among the strains highest in flour yield in last year's tests. Thatcher X Triunfo SD 343 was lowest in flour yield of the samples tested.

The milling characteristics were satisfactory for most of the varieties and strains. Thatcher X Triunfo SD 343, was for the second season the softest textured strain among the Uniform Regional Nursery samples. This strain milled very soft and was difficult to sieve or bolt. Thatcher X Triunfo also had a high pearling index value indicative of the soft nature of the grain. A number of the other strains showed hard milling characteristics. These were 1750 X 1753 N. 2095, Pilot² X Merit N. 2174, Hope X Tinstein II-39-51 and Am¹⁰ X Newthatch Ns. 3684. 1764 X

Henry N. 2211 was unsatisfactory in milling, being hard and vitreous and required more than the normal number of reductions to reduce the middlings to flour. Samples of N. 1764, one of the parents in this strain, has been characterized in previous years' tests by difficult milling properties.

The flour ash content was generally high with only a few strains averaging in the desired lower range. Those lowest in ash content and averaging .50 percent or less were Pilot X Mida N. 1953, Thatcher X W38 Hope W 246, Thatcher X Surpresa II-39-8, H.R.R. X Mercury SD 1691 and Thatcher X Triunfo SD 343.

There was a rather narrow range in bread-baking quality. Most of the loaf volumes were good considering the protein content of the varieties and strains with the greatest percentage of them having optimum loaf volumes higher than 900 cc. The five varieties and strains having the highest optimum loaf volumes were Thatcher, Pilot² X Merit N 2174, 1764 X Henry N 2211, and Tinstein X Newthatch II-42-30 II-42-38. Two of the strains lowest in loaf volume were 1552 X Mida N. 1924.44 and Am¹⁰ X Newthatch Ns. 3684. Those having the best grain-texture and crumb color were Pilot X Mida N. 1953, Hope X Tinstein II-39-47, Ns. 2744 X 2809, N. 3274 and Thatcher X Triunfo SD 343. Am¹⁰ X Newthatch N. 3684, in addition to being low in loaf volume was one of the poorest in grain-texture and crumb color.

The flour varied over a wide range of 10.0 percent in water absorption. Thatcher X Triunfo SD 343, like last year's sample, was again lowest and Hope X Tinstein II-39-51 and Pilot² X Merit N 2174, were highest.

The range in mixing time was rather narrow with only a few samples varying much from the average. Thatcher X Apex S 2176, Pilot² X Merit N. 2174, 1764 X Henry N. 2211, Hope X Tinstein II-39-47 and Pilot X Merit N. 1996 were longest and those shortest in mixing time were Thatcher X Surpresa II-39-8, Tinstein X Newthatch II-42-30, Am¹⁰ X Newthatch Ns. 3684 and Thatcher X Triunfo SD 343.

The response to oxidizing agents did not vary greatly among the 26 varieties and strains compared. About half of the varieties and strains required the same amount of oxidizing agents as Thatcher. Of the other samples, about one-fourth required less and the rest slightly higher amounts of oxidizing agents than Thatcher. All were within the range generally considered satisfactory for hard red spring wheat.

Probably the most all around outstanding strains tested this year from the Uniform Regional Nursery are Tinstein X Newthatch II-42-30 and 1764 X Henry N 2211 and Ns. 2744 X 2809, N. 3274. Other strains that are promising, except for a single deficiency are Pilot X Mida N. 1953 because of low protein; and 1750 X 1753 N. 2095 and Hope X Tinstein II-39-47 and II-39-51 because of questionable milling properties.

Table 5.--Yield, milling, baking and chemical results on 26 wheats grown in the Uniform Regional Nursery for the Eastern Composite, Western Composite and the averages of the Eastern and Western Composites in 1949.

Eastern Composite 1/

Variety or Cross	State or N. No.	C. I. No.	Acre Yield	Test Weight	Pearl- ing Index	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Baking Methods and Volume			Average	
						Wheat	Pct.	Yield	Ash			No. 6	Aver. 3 best	Opti- mum Bromate	Weight of Loaf	Crumb Color
			Bu.	Lbs.	Pct.	Pct.	Pct.	Pct.	Pct.	Min.	Cc.	Cc.	Mg.	Grams	Score	Score
Timstein x Newthatch	II-42-30	12739	25.1	57.1	29.9	16.0	14.9	72.8	.60	64	1.5	991	1004	146	78	85
Thatcher	10003	10003	19.9	53.9	24.0	14.9	14.3	72.4	.55	64	2.5	946	998	150	73	92
Redman	HL1834	12638	22.1	54.4	27.9	15.1	14.7	72.0	.56	64	2.5	980	995	150	82	92
Amlo x Newthatch	Ns 3645	12743	24.4	55.5	24.9	16.1	15.4	71.8	.58	67	2.5	953	992	148	85	90
That. x Supra	II-39-2	12641	27.3	60.8	28.8	15.4	14.9	76.3	.54	63	1.5	944	980	149	73	92
Pilot ² x Merit	2174	12732	21.4	55.9	18.4	14.7	13.7	71.3	.70	70	3.0	974	955	152	83	88
1750 x 1753	2095	12551	18.8	58.2	22.7	15.4	14.5	72.3	.61	66	2.5	935	962	150	85	90
Timstein x Newthatch	II-42-38	12740	23.8	56.5	25.3	16.3	15.6	72.0	.60	68	2.5	925	956	148	78	87
Pilot x Merit	1996	12648	20.3	56.7	22.3	14.4	13.4	73.0	.57	62	3.0	928	950	144	75	87
1764 x Henry	2211	12733	26.9	58.0	19.1	14.8	14.1	70.1	.52	67	3.0	948	948	151	78	87
That. x 1038-Hope	Wis. 246	12649	21.2	55.7	24.8	14.6	13.6	71.7	.51	62	2.0	945	945	147	77	90
That. x Apex	Sask. 2176	12639	19.1	57.0	22.7	14.6	13.7	73.4	.55	64	3.0	945	945	149	73	92
Marquis	3641	17.8	56.2	25.7	25.7	14.5	13.8	71.4	.58	64	2.0	937	937	147	75	88
H.R.R. x Mercury	SD 1691	12499	20.9	57.8	28.5	15.2	14.1	71.0	.52	65	2.0	936	936	149	83	90
Regent x 1315	1950	12745	16.7	53.5	25.3	13.9	13.0	72.2	.58	62	2.5	899	936	146	77	88
1552 x Mida	2083	12543	23.5	59.0	24.4	14.1	13.2	71.5	.61	65	2.0	929	929	149	72	88
Hope x Timstein	II-39-47	12545	26.6	58.0	26.2	15.3	14.6	74.1	.60	69	3.0	925	925	150	87	90
Ns 2744 x 2809	Ns 3291	12741	24.5	58.4	26.8	14.6	14.0	76.0	.63	68	2.5	900	922	150	80	88
Pilot x Mida	1953	12445	24.4	59.7	24.0	13.6	13.1	74.0	.52	65	2.5	880	906	150	87	93
Hope x Timstein	II-39-51	12546	27.4	59.5	25.5	14.8	14.4	74.1	.62	72	2.0	890	905	154	85	87
Amlo x Newthatch	Ns 3687	12744	22.7	57.5	24.9	15.1	14.0	73.1	.59	64	2.0	893	903	148	77	85
Ns 2744 x 2809	Ns 3274	12643	24.9	58.2	28.5	14.5	13.7	75.1	.58	67	2.0	893	901	150	85	87
Thatch. x Triunfo	SD 343	12497	26.0	59.8	32.9	15.0	13.8	72.5	.54	60	1.5	830	888	145	85	88
1750 x 1753	2092	12549	23.0	59.0	25.2	14.3	13.3	73.3	.57	64	2.5	876	876	151	78	88
Amlo x Newthatch.	Ns 3684	12742	24.6	55.3	25.7	15.7	14.9	71.9	.64	67	1.5	873	873	154	72	80
1552 x Mida	1924-44	12746	21.4	57.6	25.4	13.7	12.6	74.4	.60	63	2.5	824	824	148	75	90
Average			22.9	57.4	25.4	14.9	14.1	72.8	.58	65	2.3	907	935	149	79	89
Range			10.7	7.3	13.9	2.7	2.6	6.2	.19	12	1.5	180	180	10	15	13

1/ Averages of 8 Eastern stations -- Madison, St. Paul, Waseca, Morris, Crookston, Langdon, Fargo and Brookings.

Table 5.--Continued

Variety or Cross	State or N. No.	C. I. No.	Acres Yield	Test Weight	Pearl- ing Index Value	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Baking Methods and Volume			Average			
						Wheat		Yield				No. 6	Aver- 3 best	Opti- mum	Ont- Bromate	Weight of Loaf	Crumb Color	Grain Tex- ture
						Pct.	Pct.	Pct.	Pct.									
1764 x Henry	2211	12733	21.8	58.0	26.9	15.9	15.3	71.9	.50	68	2.5	974	952	974	1	150	75	83
Timstein x Newthatch	11-42-30	12739	22.8	58.0	31.7	15.6	14.8	71.8	.45	54	1.5	945	931	974	0	146	83	87
Timstein x Newthatch	11-42-38	12740	20.8	57.0	27.9	16.3	15.8	73.0	.58	67	2.5	945	917	945	1	148	83	87
Pilot2 x Merit	2174	12732	22.8	57.6	23.2	15.0	14.2	73.2	.55	68	2.5	922	901	931	0	152	82	90
1750 x 1753	2095	12551	18.9	59.0	26.7	15.9	15.0	72.5	.53	65	2.5	894	883	928	0	148	87	90
Thatch. x Supresa	11-39-8	12641	22.6	59.7	30.8	15.9	15.3	73.5	.44	60	1.5	911	891	911	1	143	75	90
Pilot x Mida	1953	12445	23.0	60.5	26.1	14.7	14.1	74.1	.47	65	2.0	908	906	910	0	150	90	92
Ns 2744 x 2809	Ns 3291	12741	20.3	58.3	29.9	15.5	14.6	75.2	.49	66	2.0	910	874	910	1	149	80	87
Thatch. x Apex	Sask. 2176	12639	19.7	58.6	25.3	15.5	14.7	73.3	.52	66	2.5	882	859	905	0	150	78	88
1552 x Mida	2083	12543	21.3	59.1	25.6	14.7	14.0	72.8	.54	67	2.0	905	886	905	1	148	73	87
Am10 x Newthatch	Ns 3685	12743	19.6	56.0	27.7	16.1	15.4	73.1	.55	67	2.0	905	868	905	1	149	78	83
Thatcher		10003	19.6	58.0	26.8	15.4	14.9	74.3	.50	66	2.5	898	875	903	0	150	75	85
Hope x Timstein	II 39-47	12545	22.8	57.4	30.1	15.7	14.9	72.5	.49	65	2.5	889	857	900	0	149	88	90
Marquis		3641	16.2	58.4	26.6	15.5	14.7	71.7	.59	64	2.5	888	858	899	0	148	77	88
Ns 2744 x 2809	Ns 3274	12643	20.7	58.0	30.0	15.5	14.5	73.3	.47	65	2.0	883	870	898	0	147	90	92
1750 x 1753	2092	12549	21.7	58.6	27.0	15.0	14.2	72.3	.51	65	2.0	842	827	896	0	150	78	88
Pilot x Merit	1996	12648	20.2	58.0	25.5	15.2	14.3	72.9	.48	64	2.5	896	866	896	1	148	78	82
Am10 x Newthatch	Ns 2687	12744	21.6	58.3	27.4	15.4	14.9	72.0	.43	65	2.0	818	816	896	0	149	72	83
Redman	RL 1834-7	12638	20.5	56.2	28.2	14.9	14.6	74.8	.53	64	2.5	892	867	892	1	146	87	90
H.R.R. x Mercury	SD 1691	12499	20.4	59.1	30.5	15.4	14.5	71.0	.45	65	2.0	882	841	888	0	148	83	87
Thatch. x Trunfo	SD 343	12497	21.9	60.3	33.4	15.6	14.5	68.8	.45	60	1.5	876	848	876	1	146	92	92
Thatch. x 1038 Hope	Wis. 246	12649	21.7	57.2	27.4	15.0	14.0	72.5	.44	64	2.0	865	842	873	0	149	77	87
1552 x Mida	1924-44	12746	21.6	58.8	30.2	14.4	13.5	75.3	.49	65	2.0	859	847	871	0	150	82	88
Regent x 1315	1950	12745	17.6	55.7	27.5	13.9	13.3	73.2	.50	65	2.5	865	838	865	1	148	77	88
Hope x Timstein	11-39-51	12546	23.8	59.4	27.1	15.2	14.4	73.5	.49	67	2.0	839	817	839	1	151	87	88
Am10 x Newthatch	Ns 3284	12742	18.4	56.7	28.0	15.8	15.0	71.4	.52	65	1.5	784	763	784	1	148	73	80

2/ Average of 6 Western dry-land stations - Mandan, Dickinson, Minot, Moccasin, Alliance and Akron.

Table 5. --Continued

Average of Eastern and Western Composite

Variety or Cross	State or N. No.	C. I. No.	Acres Yield	Test Weight	Pearl Index Value	Protein		Flour		Ab- sorp- tion Time	Mix- ing Time	Opti- mum Bro- mate	Methods and Volume			Average		
						Wheat	Flour	Yield	Ash				No. 6	3 best	Opti- mum	Weight of Loaf	Crumb Color	Grain Tex- ture
Bu.	Lbs.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Min.	Mg.	Cc.	Cc.	Cc.	Grams	Score	Score	
Timstein x Newthatch	II-42-30	12739	24.0	57.6	31.3	15.8	14.9	72.3	.53	64	1.5	0.5	975	961	989	146	81	86
1764 x Henry	2211	12733	24.4	58.0	23.0	15.4	14.7	71.0	.51	68	2.8	1.0	961	934	961	151	77	25
Pilot2 x Merit	2174	12732	22.1	56.8	20.8	14.9	14.0	72.3	.63	69	2.8	0.5	948	928	953	151	83	89
Timstein x Newthatch	II-42-38	12740	22.3	56.8	26.6	16.3	15.7	72.5	.59	68	2.5	1.5	935	916	951	148	81	87
Thatcher	Check		19.8	57.0	25.4	15.2	14.6	73.4	.53	65	2.5	0.5	948	911	951	150	74	89
Am10x Newthatch	3685	12743	22.0	55.8	26.3	16.1	15.4	72.5	.57	67	2.3	1.0	949	911	949	149	82	87
Thatcher x Supresa	II-39-8	12641	25.0	60.3	29.8	15.7	15.1	74.9	.49	62	1.5	1.5	934	918	946	146	74	91
1750 x 1753	2095	12551	18.9	58.6	24.7	15.7	14.8	72.4	.57	66	2.5	0.5	928	909	945	149	86	90
Redman	1834-7	12638	21.3	55.3	28.1	15.0	14.7	73.4	.55	64	2.5	1.5	936	919	944	148	85	91
Thatcher x Apex	S. 2176	12639	19.4	57.8	24.0	15.1	14.2	73.4	.54	65	2.8	0.5	914	885	925	150	76	90
Pilot x Merit	1996	12648	20.3	57.4	23.4	14.8	13.9	73.0	.53	63	2.8	1.5	912	890	923	146	77	90
Marquis	Check	3641	17.0	57.3	26.2	15.0	14.3	71.6	.59	64	2.3	0.5	913	885	918	148	76	83
1552 x Mida	2083	12543	22.4	59.1	25.0	14.8	13.6	72.2	.58	66	2.0	1.0	917	889	917	149	73	88
Ns 2744 x 2809	3291	12741	22.4	58.4	28.4	15.1	14.3	75.6	.56	67	2.3	1.0	916	887	916	150	80	88
Hope x Timstein	II-39-47	12545	21.7	57.7	28.1	15.5	14.8	73.3	.55	67	2.8	0.5	907	888	913	150	88	90
H.R.R. x Mercury	SD 1691	12499	20.7	58.5	29.5	15.3	14.3	71.0	.49	65	2.0	0.5	909	875	912	149	83	89
Thatcher x 1038 Hope	W 246	12649	21.5	56.5	26.1	14.8	13.8	72.1	.48	63	2.0	0.5	905	878	909	148	77	89
Pilot x Mida	1953	12445	23.7	60.2	25.1	14.2	13.6	74.1	.50	65	2.3	0.5	907	893	908	150	89	93
Regent x 1315	1950	12745	17.2	54.6	26.4	13.9	13.2	72.7	.54	64	2.5	1.5	882	866	901	147	77	88
Ns 2744 x 2809	3274	12643	22.8	58.1	29.3	15.0	14.1	74.2	.53	66	2.0	1.0	888	876	900	149	88	90
Am10 x Newthatch	3687	12744	22.2	57.9	26.2	15.3	14.5	72.5	.51	65	2.0	0.0	856	849	900	149	76	84
1750 x 1753	2092	12549	22.4	58.8	26.1	14.7	13.8	72.8	.54	65	2.3	0.5	859	838	886	151	78	88
Thatcher x Triumfo	SD 343	12497	23.9	60.1	33.2	15.3	14.2	70.7	.50	60	1.5	2.0	853	853	882	146	89	90
Hope x Timstein	II-39-51	12546	25.6	59.5	26.3	15.0	14.4	73.8	.56	70	2.0	1.5	865	856	872	153	86	88
1552 x Mida	1924-44	12746	21.5	58.2	27.8	14.1	13.1	74.9	.55	64	2.3	0.5	842	831	848	149	79	89
Am10x Newthatch	3684	12742	21.5	56.0	26.9	15.8	15.0	71.7	.58	66	1.5	1.0	829	799	829	151	73	80
Average			21.9	57.8	26.7	15.1	14.4	72.8	.54	65	2.2	0.9	908	886	917	149	80	89
Range			8.6	5.7	12.4	2.4	2.6	4.9	1.5	10	1.3	2.0	133	130	141	7	16	13

Table 6. Yield, milling, baking, and chemical results on hard red spring wheats grown in Intrastate Nurseries composited from stations indicated, 1949 crop.

North Dakota Intrastate Nursery 1/

Variety or cross	State or N. No.	C. I. No.	Acres yield	Test weight lbs.	Pearling index	Protein		Flour Yield		absorption	Mixing time	Methods & Volume		Opt. bro.	Average	
						Pct.	Pct.	Pct.	Pct.			No. 6	Avg. 3 best		Loaf weight	Crumb Grain color tex.
			Bu.		Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Min.	Cc.	Cc.	Mg.	Grams	Score
1750 X Timstein	2237	12734	20.6	59.7	48.8	17.4	17.0	71.2	47	66	1.5	1027	1072	1107	151	85
5.8.6.3	3670		17.6	58.2	32.0	16.3	16.4	73.9	49	68	2.0	1072	1067	1090	152	77
1.14.13	3730		19.0	57.5	31.0	17.0	16.7	72.2	54	66	2.0	1079	967	1079	151	73
Lee X 3175	3729		24.9	59.6	35.3	16.8	16.4	73.2	50	69	2.5	1064	1016	1064	149	82
1764 X Henry	2232	12637	20.8	57.1	28.3	15.5	15.1	72.8	47	69	2.5	992	1011	1044	148	73
2744 X 2809	3291	12741	25.5	60.3	33.0	16.2	15.2	74.5	47	68	2.5	1044	984	1044	151	80
14.3.2.4	3674		19.5	57.0	26.9	16.0	15.4	73.7	52	67	3.0	1033	958	1033	151	72
1764 X Henry	2250		21.2	58.2	28.6	15.6	14.7	72.6	51	68	2.5	1024	976	1024	149	75
Thatcher			20.6	59.4	28.7	16.0	15.1	74.4	49	67	2.5	1027	976	1027	150	77
Henry X Cadet	2239	12779	20.9	58.9	30.9	16.6	16.1	73.6	49	69	2.5	940	989	1015	153	73
Pilot X Newthatch	2144		20.7	57.3	27.4	15.5	15.2	74.4	48	64	2.5	1015	957	1015	145	80
3.6.3.4	3662		24.9	56.8	30.5	16.5	16.0	73.9	48	66	2.0	937	948	1015	151	68
1750 X Timstein	2313	12778	20.7	59.7	35.2	16.0	15.3	73.0	42	64	2.0	986	969	989	146	75
1750 X 1753	2115	12640	20.7	61.0	23.6	16.4	15.5	72.5	51	68	3.0	989	941	989	152	80
14.5.8. and 9	3731		17.5	56.5	23.9	15.9	15.0	68.6	51	70	3.5	983	951	983	152	75
Reg. Mida X 1552-Mida	2286		23.9	59.8	30.1	15.0	14.6	74.6	49	66	2.5	948	917	974	151	82
Pilot2 X Merit	2164	12735	20.9	59.4	23.3	15.2	14.2	72.7	53	70	3.5	912	915	948	152	80
Pilot2 X Thatcher	2030	12736	17.7	58.2	28.3	15.4	15.9	73.7	59	71	3.0	910	809	948	152	78
1552 X Mida	2223	12785	23.1	59.2	31.4	15.8	15.2	75.7	53	66	2.0	923	932	945	151	73
1552 X Mida	1924-110		21.8	60.6	30.6	15.0	13.9	75.2	53	64	2.0	908	922	945	149	75
R. L. 2265 X Redman	3386.4		21.4	59.9	34.6	16.8	16.4	71.5	50	68	2.0	939	890	939	152	78
Henry X 1907	2242	12777	21.8	60.8	32.6	16.4	15.4	72.2	45	65	2.0	912	896	928	148	82
5.2	3658		21.4	59.2	32.2	16.3	15.6	71.5	49	67	2.0	928	890	928	151	73
3.6.3.6	3664		21.9	57.3	34.7	17.3	16.7	74.1	54	67	2.0	925	871	925	151	70
Regent X Mida	1844-38		19.4	57.3	29.3	14.8	13.8	72.9	48	66	2.0	914	868	914	151	80
1764 X 1750	2246	12737	21.9	60.2	24.5	15.1	14.2	72.1	56	72	3.0	812	834	812	154	82
Average			21.2	58.8	30.6	16.0	15.4	73.2	50	67	2.4	971	944	989	151	77
Range			8.0	4.4	25.5	2.6	3.2	7.1	17	8	1.5	267	263	295	9	17

1/ Fargo, Langdon, Mandan, and Dickinson.

Table C.-- Continued

Montana Intrastate Nursery 1/

Variety or Cross	State or N. No.	C. I. No.	Acres Yield	Test Weight	Pearl- ing Index Value	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Baking Methods and Volume			Average					
						Wheat		Flour				Yield	Ash	No. 6	Aver. 3 best	Opti- mum	Opti- mum Bromate	Weight of Loaf	Crumb Color	Grain Tex- ture
						Pct.	Pct.	Pct.	Pct.											
						Bu.	Lbs.	Pct.	Pct.											
Thatcher		10003	27.6	59.8	26.1	15.5	15.1	72.5	.47	70	2.5	908	878	908	1	155	78	83		
Pilot ² x Regent	2363		28.0	60.0	29.0	15.2	14.8	72.8	.46	67	2.0	908	875	908	1	150	80	90		
Pilot ² x Regent	2183		30.3	60.0	28.8	14.5	13.5	71.5	.48	66	2.0	891	890	899	0	152	85	92		
Pilot x Wida	1964		25.7	50.5	28.4	14.5	13.7	73.6	.39	69	2.5	859	846	899	0	150	88	85		
N 1520 x N 1753	2361		26.0	61.7	27.9	14.9	14.0	74.7	.50	67	1.5	845	853	878	0	150	82	92		
N 1764 x N 1753	2213	12738	26.6	59.8	26.0	14.6	13.9	72.0	.43	69	2.5	859	837	859	1	150	78	83		
Comet x Pilot ²	1915		26.9	60.7	28.7	14.9	14.5	71.6	.54	66	2.0	821	828	859	0	152	82	85		
Pilot x N 1514	1931		26.7	60.7	27.1	14.0	13.1	72.1	.46	67	2.0	746	768	851	0	154	73	83		
N 1520 x N 1753	2362		25.7	61.5	24.5	14.3	13.2	71.6	.52	66	2.0	812	811	848	0	150	82	87		
Pilot x Merit	1993		27.2	60.1	25.2	14.6	13.6	70.9	.45	70	2.5	815	797	833	0	152	80	85		
Pilot ² x Thatch.	2170		27.1	60.6	26.2	14.3	13.6	71.3	.38	63	2.0	738	765	815	0	150	83	87		
N 1585 x Cadet	2118	12788	31.0	60.6	29.5	14.2	13.3	71.0	.41	67	2.0	807	787	813	0	154	75	83		
Pilot ² x Merit	2164	12735	29.3	59.2	21.1	14.5	13.6	72.2	.48	70	2.0	800	784	809	0	152	77	87		
N 1760 x Pilot	2220		29.4	62.0	27.5	14.4	13.8	72.8	.45	68	2.0	801	778	301	1	156	78	85		
N 1520 x N 1753	2247		30.4	60.0	26.0	13.9	13.0	72.6	.41	67	2.0	795	777	801	0	153	80	83		
N 1568 x Merit	2114		25.8	50.3	24.2	15.0	14.1	73.4	.49	74	2.0	789	782	789	1	156	82	87		
Average			27.7	60.5	26.6	14.6	13.8	72.3	.46	68	2.1	825	816	848	.31	152	80	86		
Range			5.3	2.8	7.9	1.6	2.1	3.8	.13	11	1.0	170	125	119	1	6	15	9		

1/ Moccasin.

Table 7 --Yield, milling, baking and chemical results on hard red spring wheats grown in the station nurseries.
Madison, Wisconsin (Station Nursery)

Variety or Cross	State or N. No.	C. I. No.	Acre Yield Bu.	Pearl- ing Index Value	Protein		Flour		Ab- sorp- tion Time	Baking Methods and Volume				Average		Grain Tex- ture	
					Wheat		Yield			No. 6	Aver- best	Opti- mum Bromate	Opti- mum Bromate	Weight of Loaf	Crumb Color		
					Pct.	Pct.	Pct.	Pct.									
					Pct.	Pct.	Pct.	Pct.									
Thatcher x W 38.-Hope	H-194-28		21.9	51.7	27.2	15.4	14.5	69.8	.53	63	948	978	1012	2	150	82	87
Do.	H-194-3-1		20.7	52.4	25.8	15.6	14.2	69.8	.53	62	974	935	974	1	148	83	85
Do.	H-194-13-7		22.6	53.2	27.6	15.3	14.1	70.0	.59	63	942	939	962	2	153	80	85
Thatcher	Check	10003	19.6	54.1	21.3	14.6	14.1	70.5	.59	62	936	926	936	1	150	73	87
Henry	Check	12265	28.3	55.0	33.5	13.8	12.6	73.6	.52	60	919	890	919	1	149	72	88
Thatcher x W 38.-Hope	H 194-79		22.8	52.0	25.3	14.6	13.3	69.3	.49	62	913	887	913	1	150	82	88
Do.	H-194-59-8		22.9	55.0	28.4	15.4	14.2	70.8	.49	62	842	837	886	0	150	85	85
Reliance x 1110	1328A-1-8-1-2		19.1	55.5	21.5	12.7	11.5	71.7	.54	60	786	764	786	1	148	82	85
Average			22.2	53.6	26.3	14.7	13.6	70.7	.54	62	908	895	924	1.13	150	80	86
Range			9.2	3.8	12.2	2.9	3.0	4.3	.10	3	188	214	226	2	5	13	3

Brookings, South Dakota (Station Nursery)

Regent x 1582	1912	12446	14.1	57.5	28.0	14.0	13.3	72.8	.62	60	871	870	871	1	144	83	87
H.R.P. x Clar.	2202		17.3	59.2	31.7	13.6	12.7	77.7	.48	60	842	824	842	1	147	93	93
1750 x Timstein	2237	12734	18.8	59.8	33.1	13.4	12.6	72.6	.52	60	842	818	842	1	148	92	95
1764 x Henry	2232	12637	19.8	56.3	27.9	12.9	12.0	72.6	.54	60	821	806	821	1	147	80	93
1520 x 1753	2247		17.1	58.4	27.1	13.6	12.5	73.1	.54	62	813	786	813	1	148	77	90
1764 x 1752	2213	12738	17.4	57.1	23.7	12.8	11.8	72.5	.63	62	801	788	801	1	147	73	88
H.R.P. x Clar.	2069		15.4	59.6	40.0	13.8	12.4	70.9	.56	56	789	792	795	2	143	90	85
Pilot		11945	16.3	57.8	25.5	12.4	11.5	72.0	.57	60	786	759	786	1	148	75	90
H.R.R. x Merc.	1191		16.2	59.7	37.4	13.1	11.5	71.8	.50	60	775	770	775	1	147	90	90
Thatch. x Tri.	139		19.7	59.5	34.2	13.9	12.8	74.6	.48	58	744	746	766	2	145	88	85
Pilot x Merit	2012	12493	14.8	57.2	20.1	13.4	12.4	72.1	.65	63	767	761	767	1	149	88	92
1586 x Merit	2011		18.3	58.2	24.9	13.1	11.9	73.3	.58	60	755	731	755	1	148	77	88
Tri. x Merc.	1315		20.0	60.8	33.9	13.2	12.1	73.9	.55	60	747	748	749	0	148	85	87
H.R.R. x Merc.	1481		20.0	60.5	25.4	13.3	12.2	75.0	.57	62	729	726	747	0	150	75	82
H.R.R. x Merc.	598		18.8	59.2	29.2	11.9	10.8	75.4	.52	60	701	697	704	0	147	70	82
Average			17.6	58.7	29.5	13.2	12.2	73.4	.55	60	786	775	789	.93	147	82	88
Range			5.9	4.5	19.9	2.1	2.5	6.8	.17	7	170	173	167	2	7	23	11

Table 7.--Continued

Langdon, North Dakota (Station Nursery) 1/

Variety or Cross	State or N. No.	C. I. No.	Acre Yield	Test Weight	Pearl- ing Index Value	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Baking Methods and Volume			Weight of Leaf	Average				
						Wheat		Flour				Yield	Ash	No. 6		Aver. 3 best	Opti- mum	Opti- mum Bromate	Crumb Color	Grain Tex- ture
						Pct.	Pct.	Pct.	Pct.											
Bu.																				
Lbs.																				
Pct.																				
Min.																				
Cc.																				
Mg.																				
Grams																				
Score																				
1764 x Henry	2249		24.7	57.8	25.2	15.6	15.1	71.7	.45	64	2.5	1084	1028	149	85	87				
Henry x Cadet	2233	12781	27.2	59.5	28.0	15.9	15.4	75.7	.44	66	2.0	1015	1022	150	80	85				
Thatcher	Check	10003	24.3	58.9	24.4	15.2	14.1	75.4	.44	64	2.0	1024	978	150	77	90				
Pilot x 1514	2014-55		23.7	60.2	24.5	15.0	14.1	72.0	.49	64	2.0	1021	937	151	82	92				
Pilot2 x Merit	2137		24.7	59.1	19.7	16.0	14.8	71.1	.51	67	2.5	984	977	152	83	88				
1750 x Timstein	2238		24.1	60.2	27.9	16.6	16.1	74.7	.50	64	2.0	889	960	153	90	87				
Regent x Pilot	2253		24.1	57.8	26.9	15.6	14.8	72.8	.47	64	3.0	969	940	151	82	87				
Mida	Check	12008	26.4	61.9	29.4	15.6	14.8	76.6	.46	65	2.5	945	894	152	87	90				
1764 x Henry	2319		24.8	59.1	22.3	16.0	15.4	75.3	.60	67	2.5	906	927	153	72	83				
1750 x Newthatch	2059		19.8	60.8	26.8	16.0	15.1	74.5	.50	60	1.5	937	908	150	83	87				
1764 x Timstein	2236		24.8	59.4	23.1	16.3	15.7	74.5	.51	65	2.5	922	914	150	83	87				
1946 x 1938	2243		21.2	58.6	19.4	16.0	15.3	71.2	.49	66	2.5	933	911	152	78	83				
Henry x 1907	2321		20.7	58.3	25.2	14.7	14.0	73.7	.49	64	3.0	916	887	151	80	87				
1568 x Merit	2011		24.7	60.6	22.6	14.4	13.7	76.6	.46	63	2.5	900	865	151	77	90				
1912 x 1919	2234		20.8	58.0	22.8	15.8	15.3	72.6	.53	64	1.5	892	866	150	77	87				
Henry x 1907	2320		26.3	59.0	23.4	15.1	14.0	73.0	.46	63	2.0	877	866	151	75	87				
1520 x 1752	2318		25.1	59.5	19.1	14.8	13.7	74.1	.48	64	2.0	871	846	150	85	87				
Mida x 1529	2214		29.8	61.2	30.2	14.3	13.2	75.8	.43	60	2.5	853	836	151	87	92				
Average																				
Range																				

1/ Langdon 3 pounds, Mandan 1-pound composite - Average acre yield for the two stations.

Table 7.--Continued

Mandan, North Dakota (Station Nursery)

Variety or Cross	Station or N. No.	C. I. No.	Acres Yield	Test Weight	Pearl- ing Index Value	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Baking Methods and Volume			Average			
						Wheat		Yield				No. 6	Aver. 3 best	Opti- mum	Opti- mum Bromate	Weight of Loaf	Crumb Color	Grain Tex- ture
						Pct.	Pct.	Pct.	Pct.									
			Bu.	Lbs.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Min.	Cc.	Cc.	Cc.	Grams	Score	Score	
1315 x Timstein	2257		21.2	55.7	34.8	17.4	16.9	71.9	.40	64	2.0	1102	1070	1134	2	150	78	
Regent x Pilot	1920		28.0	54.5	27.2	17.3	16.8	71.9	.46	65	2.5	1116	1048	1116	1	148	73	
1764 x Henry	2270		27.6	56.7	28.0	16.6	16.2	71.7	.33	66	2.5	1087	1085	1113	2	149	77	
Henry x 1907	2317		28.5	59.2	31.2	16.6	15.7	72.2	.34	65	2.5	1098	1015	1098	1	148	77	
Regent x Pilot	2245		29.5	56.9	29.8	16.5	15.9	72.1	.41	64	2.0	1087	1059	1087	1	146	82	
Thatcher	Check	10003	30.7	57.8	28.5	17.0	16.4	72.2	.38	66	2.0	1072	1009	1072	1	151	75	
1764 x 1753	2213	12738	28.6	56.1	25.9	16.9	15.8	71.1	.42	65	2.5	1066	1014	1066	1	150	80	
Merit ² x Thatch.	2112		27.7	54.9	21.5	16.7	15.9	71.1	.50	69	3.0	1027	945	1027	1	152	87	
Henry x Cadet	2316		32.0	55.5	31.8	16.0	15.4	72.9	.38	65	2.0	940	986	1010	3	151	70	
Mida	Check	12008	27.5	59.0	33.4	16.7	16.1	75.0	.42	64	2.0	995	952	995	1	150	90	
Pilot ² x Thatch.	2170		28.0	57.6	27.1	15.9	15.3	71.3	.41	63	3.0	980	958	992	0	149	80	
1750 x 1752	2218		31.6	53.4	33.1	16.8	15.9	72.4	.42	62	1.5	980	939	980	1	150	88	
Pilot x 1514	2014-80		29.7	57.8	27.8	15.8	14.9	72.2	.44	63	2.0	980	926	980	1	150	77	
1691 x 1753	2276		29.9	57.4	28.3	16.0	15.0	72.3	.38	65	2.5	971	927	971	1	150	82	
1520 x 1753	2247		26.6	57.8	30.1	15.7	14.7	71.4	.34	64	2.5	956	922	956	1	151	80	
1764 x 1750	2209		25.4	58.4	22.0	16.1	15.3	72.6	.42	65	2.5	903	882	903	1	150	87	
Average			28.3	57.2	28.8	16.5	15.8	72.1	.40	65	2.3	1023	981	1031	1.19	150	80	
Range			10.8	4.9	13.3	1.7	2.2	3.9	.17	7	1.5	213	203	231	3	6	20	

Table 7.--Continued

Moccasin, Montana (Station Nursery)

Variety or Cross	Station or N. No.	C. I. No.	Acres Yield	Test Weight	Pearl- ing Index Value	Protein		Flour		Ab- sorp- tion	Mix- ing Time	Baking Methods and Volume				Average		
						Wheat	Flour	Field	Ash			No.	Aver. 3 best	Opti- mum	Opti- mum	Weight of Loaf	Crumb Color	Grain Tex- ture
Pct.	Pct.	Pct.	Pct.	Min.	Cc.	Cc.	Cc.	Mg.	Grams	Score	Score							
Pilot		11945	32.3	58.0	28.1	14.6	14.1	72.6	.46	70	2.5	1044	989	1044	1	151	75	83
Thatcher		10003	29.6	59.4	28.9	15.1	15.1	73.5	.49	71	2.5	989	924	989	1	155	72	82
N 1750 x Newthatch	1437A-1-1-1-4		33.2	61.2	26.9	15.2	14.7	71.6	.50	70	2.0	977	970	977	1	154	88	88
Pilot x N 1514	2014-80		32.4	59.7	27.8	14.9	14.1	71.8	.48	72	2.0	951	919	951	1	154	70	87
Pilot x N 1315	2267		32.1	60.4	31.2	14.3	13.7	73.0	.42	73	3.0	928	864	928	1	155	85	85
N 1764 x 1750	1463A-1-33-1-2		28.3	59.6	23.6	15.2	14.8	73.8	.53	72	3.0	919	834	919	1	156	75	80
Ceres		6900	32.6	60.8	26.2	14.3	14.0	71.9	.47	73	3.0	905	871	905	1	156	77	90
N 1752 x N 1753	2277		29.6	60.6	28.2	14.2	13.8	72.3	.43	71	3.0	905	868	905	1	155	75	88
N 1520 x N 1753	2102		28.6	61.0	25.9	14.9	14.2	70.1	.46	69	2.5	853	876	899	0	151	80	85
N 1750 x N 1753	2259		28.3	60.9	29.1	14.9	14.1	70.7	.45	71	2.5	874	880	886	0	154	80	85
N 1829 x 1750	1460A-1-23-3-2		33.0	61.2	28.0	14.0	13.6	73.5	.41	70	2.5	845	854	862	0	154	73	88
N 1828 x 1750	1461A-1-6-3-2		25.7	59.8	27.3	14.5	13.9	72.1	.41	68	2.0	859	825	859	1	153	77	88
N 1828 x 1750	1461A-1-25-3-2		32.5	60.5	29.1	13.5	12.8	73.9	.42	69	2.5	859	812	859	1	156	77	87
N 1750 x N 1753	2256		32.8	61.4	27.7	14.0	13.2	71.3	.40	69	2.5	845	830	845	1	156	80	88
N 1691 x 1756	2035-1		29.6	61.2	26.5	14.0	13.5	73.6	.48	67	2.0	842	807	842	1	152	82	85
N 1760 x 1750	1450A-2-49-3-3		32.6	62.5	26.2	14.8	14.1	71.7	.50	69	2.0	772	774	775	0	156	73	75
Average			30.8	60.5	27.5	14.5	14.0	72.3	.46	70	2.5	898	869	903	.75	154	77	85
Range			7.5	4.5	5.3	2.4	1.9	3.8	.13	6	1.0	272	215	269	1	4	16	15

UNIFORM VARIETIES BAKED BY SEVEN STRAIGHT-DOUGH METHODS
AND TWO SPONGE-DOUGH METHODS

The composite flours of the seven uniform plot varieties (table 2) for the Eastern and Western sections were baked by seven straight-dough methods and two sponge-dough methods. The regular bread-baking formulas and the malt-phosphate-bromate formula with four different fermentations were baked by the straight dough method. The malt-phosphate-bromate-baking procedure is one of a number of other methods used by some laboratories in this country as well as in Canada. In the sponge-dough method a 3-hour sponge was used with 40 and 60 minutes in the dough. The sponge-dough method is generally used in bakeries for the commercial production of bread and in laboratories association with the baking industry for testing purposes. The baking results are given in table 8 and other chemical and milling results in table 2.

Straight-Dough Methods

The baking procedure by the regular formula produced the largest loaf volumes from the Eastern section samples with 1 milligram of bromate but the Western section samples with no bromate averaged best in volume. The largest loaves, by the malt-phosphate-bromate-baking method were generally produced by the 1.5 hour fermentation time. The 1.5 hour fermentation malt-phosphate-bromate bake for the Eastern section samples produced loaves that were nearly the same in volume as those produced by the regular method with 2 milligrams of bromate added. In the Western section, the agreement was best between the regular method with 1 milligram of bromate and the 1.5 hour fermentation malt-phosphate-bromate bake. The varieties showing a high degree of tolerance to length of fermentation time were Cadet and Mida X Cadet N. 1831 (Eastern section) and Cadet from the Western section. Those varieties showing a low degree of tolerance to length of fermentation time were Mida (Eastern section) and Thatcher, Pilot and Mida X Cadet in the Western section. The Eastern section samples showed a higher degree of tolerance to length of fermentation than the Western section samples. Those varieties averaging best in loaf volume by the average of all methods were Cadet, Mida X Cadet, and Thatcher in the Eastern section and Thatcher, Cadet, and Mida X Cadet in the Western section. Cadet and Mida X Cadet were among the better samples in last year's tests. The average for both sections shows Thatcher and Cadet had the highest volumes for all methods, with Mida and Lee the lowest..

Sponge-Dough Methods

The best loaf volumes by the sponge-dough methods were generally lower than those obtained by the straight-dough method when compared by variety. Sixty minutes in the dough produced better loaf volumes than the shorter dough time. The sponge-dough method appears to narrow the spread in loaf volume between the different varieties more than when the straight-dough method is used. In the Eastern section, (60 min. dough) Cadet, Thatcher, and Lee are best but the differences are small in comparison with the three other varieties and strains. In the Western section (60 min. dough) Thatcher and Pilot are best and Mida X Cadet N 1831 poorest of the group. An average of the Eastern and Western section (60 min. dough) shows little difference between the varieties with Thatcher possibly best.

Table 8. Uniform Varieties, 1949, composited from Eastern and Western Sections and baked by seven straight dough methods and two sponge and dough methods.

Section and variety	Flour protein	Straight-dough methods							Sponge-dough methods		
		Regular formula mil. bromate			Malt-phosphate-bromate fermentation time (hrs)				Average 7 methods	Minutes in	
		0	1	2	1.5	2.0	2.5	3.0		40	sponge 60
<u>Eastern Section</u>											
Cadet	13.7	859	971	950	876	882	842	812	885	795	900
Mida X Cadet 1831	12.9	862	931	886	853	865	830	772	857	800	888
Thatcher	13.7	954	909	839	870	865	772	760	853	836	900
Lee	14.4	943	931	842	830	818	749	714	832	865	910
Mida	13.0	867	869	803	859	824	732	693	807	806	876
Rival	12.8	876	850	792	783	772	686	668	775	806	870
Average	13.8	894	910	852	845	838	769	737	835	818	891
<u>Western Section</u>											
Thatcher	15.4	1030	969	871	1009	950	859	749	920	818	922
Cadet	14.8	939	936	856	950	896	766	760	872	824	870
Mida X Cadet 1831	14.0	922	912	842	900	870	709	668	832	818	842
Pilot	14.1	945	865	798	870	853	704	640	811	888	945
Mida	14.2	885	881	783	853	847	704	646	800	778	876
Lee	15.1	917	896	859	824	795	668	628	798	778	882
Average	14.6	940	910	835	901	868	735	683	839	817	890
<u>Average Eastern & Western</u>											
Thatcher	14.6	992	939	855	940	908	816	755	886	827	911
Cadet	14.3	899	954	903	913	889	804	786	878	810	885
Mida X Cadet	13.5	892	922	871	877	868	770	720	846	809	885
Lee	14.8	930	914	851	827	807	709	671	816	822	898
Mida	13.6	876	875	793	856	836	718	670	803	792	876
Average	14.2	918	921	855	883	862	763	720	846	815	891

Table 9. Milling, baking, and chemical results on seventeen composite commercial samples of hard red spring wheat obtained at Denver, Colorado; Great Falls, Montana; Duluth and Minneapolis, Minnesota representing the 1949 crop.

Location where obtained	Carlott receipts composited	U. S. grade	Test weight value	Pearling index	Protein		Flour Yield	Ab- sorp- tion time	Method & Volume			Opt. bro.	Loaf weight	Average Crumb color texture				
					Wheat Flour	Pct.			Pct.	Pct.	No. 6				Avg. 3	Cc.	Cc.	Cc.
Denver, Colo.																		
Do	16	1 Hvy. D.N.S.	61.7	28.9	12.5	11.7	72.6	.52	63	1.5	755	767	800	0	151	83		
Do	18	1 D.N.S.	59.5	26.3	13.7	12.8	73.4	.53	66	2.0	871	878	905	0	151	78		
Do	11	1 Hvy. N.S.	60.6	29.8	11.4	10.5	73.2	.53	68	2.5	755	715	755	1	156	77		
Great Falls, Mont.																		
Do	699	1 Hvy. D.N.S.	61.6	31.1	13.6	13.2	74.2	.44	67	2.0	916	877	916	1	152	78		
Do	66	1 D.N.S.	59.4	31.3	15.1	14.8	73.6	.50	69	2.5	992	956	992	1	150	78		
Do	79	2 D.N.S.	61.3	31.1	13.5	13.1	74.9	.47	67	2.5	874	857	874	1	150	78		
Duluth, Minn.																		
Do	273	1 Hvy. D.N.S.	60.7	30.9	13.4	13.1	75.8	.52	66	2.5	896	871	896	1	152	82		
Do	223	1 D.N.S.	59.3	31.8	14.0	13.8	76.6	.54	67	2.0	912	894	914	2	151	82		
Do	96	2 D.N.S.	58.8	31.1	14.3	14.0	75.5	.54	67	2.5	934	913	934	1	153	82		
Do	104	1 N.S.	59.7	30.3	12.9	12.1	74.8	.53	68	2.5	854	833	854	1	155	83		
Minneapolis, Minn.																		
Do	175	1 Hvy. D.N.S.	61.3	30.6	13.3	13.0	75.8	.51	68	2.0	928	889	928	1	155	82		
Do	165	1 D.N.S.	59.6	32.4	13.9	13.5	75.5	.56	69	2.5	937	910	937	1	153	82		
Do	105	2 D.N.S.	57.5	31.0	14.5	14.1	75.2	.54	69	2.5	977	932	977	1	154	83		
Do	51	3 D.N.S.	56.5	31.3	14.1	13.6	73.7	.60	69	3.0	945	915	945	1	154	83		
Do	90	1 Hvy. N.S.	60.9	34.2	12.7	12.0	76.1	.49	67	2.5	830	812	830	1	154	78		
Do	130	1 N.S.	59.3	32.9	13.1	12.3	76.9	.58	68	2.5	859	838	859	1	154	83		
Do	123	2 N.S.	58.1	31.8	13.2	12.3	75.6	.59	67	2.5	873	847	873	1	152	83		
Average																		
			59.8	31.0	13.5	12.9	74.9	.53	67	2.4	889	865	893	.94	153	81		
Range			5.2	7.9	3.7	4.3	4.3	.16	6	1.5	237	241	237	2	6	6		

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COMMERCIAL SAMPLES

As in past years a number of commercially grown wheat samples were obtained through the Grain Branch, Production and Marketing Administration, for comparison with the varieties and strains produced in experimental plots. Seventeen such samples, representing a number of grades and types were obtained at Denver, Colorado; Great Falls, Montana; and Minneapolis and Duluth, Minnesota. The samples were composited by grade from 2,424 cars of wheat grading No. 3 or better. This is the eleventh season such samples have been tested. The results are given in table 9.

These samples generally averaged lower in protein content than the experimental plots and nursery samples. Otherwise, the milling, baking, and chemical results do not appear to be greatly different, especially when compared with samples having approximately the same protein content and test weight per bushel.

CORRELATION AND REGRESSIONS

Correlation coefficients (r) for optimum loaf volume and flour protein content of 10 varieties and strains have been calculated and are presented in table 10. Also shown in this table is the slope of the regression line or the change in loaf volume for each 1.0 percent of protein (b_1), the average protein content of the flour and the loaf volume of the bread, and the loaf volumes adjusted to a 13.0 percent protein basis by the means of the regression equation. The plotted regression lines for each variety are shown in two graphs in figure 1.

The graphs show that the relation between loaf volume and protein content is generally linear. These results are in accordance with the last 5 years (1944 to 1948) where, with a few exceptions, the points fell on or very close to the calculated regression lines. Most of the correlation coefficients for loaf volume and flour protein content are high. The highest coefficients are for Pilot X Mida N 1953, Mida and Pilot X Merit N 1898. The wheats having the lowest coefficients this season are Lee and Thatcher. Both of these varieties had low coefficients in last season's tests. It should be noted that the number of samples of each variety is rather small for a study of this kind. This fact should be considered in evaluating the results.

One of the important results of this study and of interest are the differences in the level and particularly in the slope of the regression lines for the different varieties. The regression lines for the seven varieties and three strains shown in the two graphs include the regression lines for Thatcher and Mida repeated in each graph as standards of comparison.

There was some variation in the slope and level of the regression lines among the varieties compared in graph 1. The slope of the line for Rushmore was steeper than the slope of the other lines compared in this group. The slope of the lines for Pilot, Rival, and Cadet were about the same but higher than that of Mida. The change in loaf volume for each 1 percent of protein was highest for Rushmore (65.4 cc.) and lowest for Thatcher (43.2 cc.). Pilot (907 cc.) was higher in loaf volume, converted to a 13.0 percent-protein basis, than Thatcher (892 cc.); while Rival (882 cc.), Cadet (878 cc.), Rushmore (867 cc.), and Mida (849 cc.) were lower in loaf volume than Thatcher.

The regression line for N 1831 was slightly higher than those for the other varieties and strains in graph B and was lower than the regression line for Thatcher. The two strains N 1953 and N 1898 appear to be similar with respect to regression lines and intermediate in this respect between Thatcher and Mida. Lee had the smallest change (37.4 cc.) in loaf volume for each 1 percent of protein among the samples compared in both graphs. Lee was also lowest in this respect among the wheats compared last season. Mida X Cadet N 1831 was the highest of this group in loaf volume (900 cc.) converted to a 13.0 percent protein basis. Pilot X Mida N 1953 (877 cc.) and Pilot X Merit N 1898 (869 cc.) were substantially alike but both were lower than Thatcher (892 cc.) (13.0 percent-protein basis) in loaf volume. Lee (858 cc.) averaged only slightly higher than Mida (849 cc.) but was lower than Thatcher (892 cc.) in loaf volume converted to a uniform protein basis.

The relative position of the regression lines appear to be a rather satisfactory measure of the relative protein quality of these varieties. From these lines the varieties and strains can be compared with each other by the means of loaf volume taken at a medium protein level (13.0 percent) as calculated from the regression lines. The loaf volume for each variety is the point at which the regression line crosses the 13.0 percent-protein value in the graphs. These loaf volumes arranged in descending order are shown in the last column of table 10. Mida X Cadet N 1831 appears to be relatively better in protein quality than either Pilot X Mida N 1953 or Pilot X Merit N 1898.

Table 10. Summary of protein content - loaf volume.

Variety or cross	State or M. No.	No. of samples	b ₁ 1/	r 2/	Protein of flour Percent	Average optimum loaf volume cc.	Loaf volume at 13.0 pct. protein content 3/
Pilot		16	52.0	.852	14.2	969	907
Mida X Cadet	1831	16	41.8	.850	13.8	933	900
Thatcher		28	43.2	.735	14.9	974	892
Rival		14	48.7	.883	13.7	916	882
Cadet		18	47.8	.823	14.6	954	878
Pilot X Mida	1953	16	47.9	.949	13.6	906	877
Pilot X Merit	1898	13	49.2	.905	14.1	923	869
Rushmore		10	65.4	.866	14.5	965	867
Lee		19	37.4	.766	15.1	936	858
Mida		22	45.5	.913	14.1	899	849

- 1/ Slope of the regression line or the cubic centimeter change in loaf volume for each 1 percent of protein.
- 2/ Correlation coefficients for loaf volume and flour protein content. All correlation coefficients are significant at the 1 percent level.
- 3/ Calculated from regression equation.

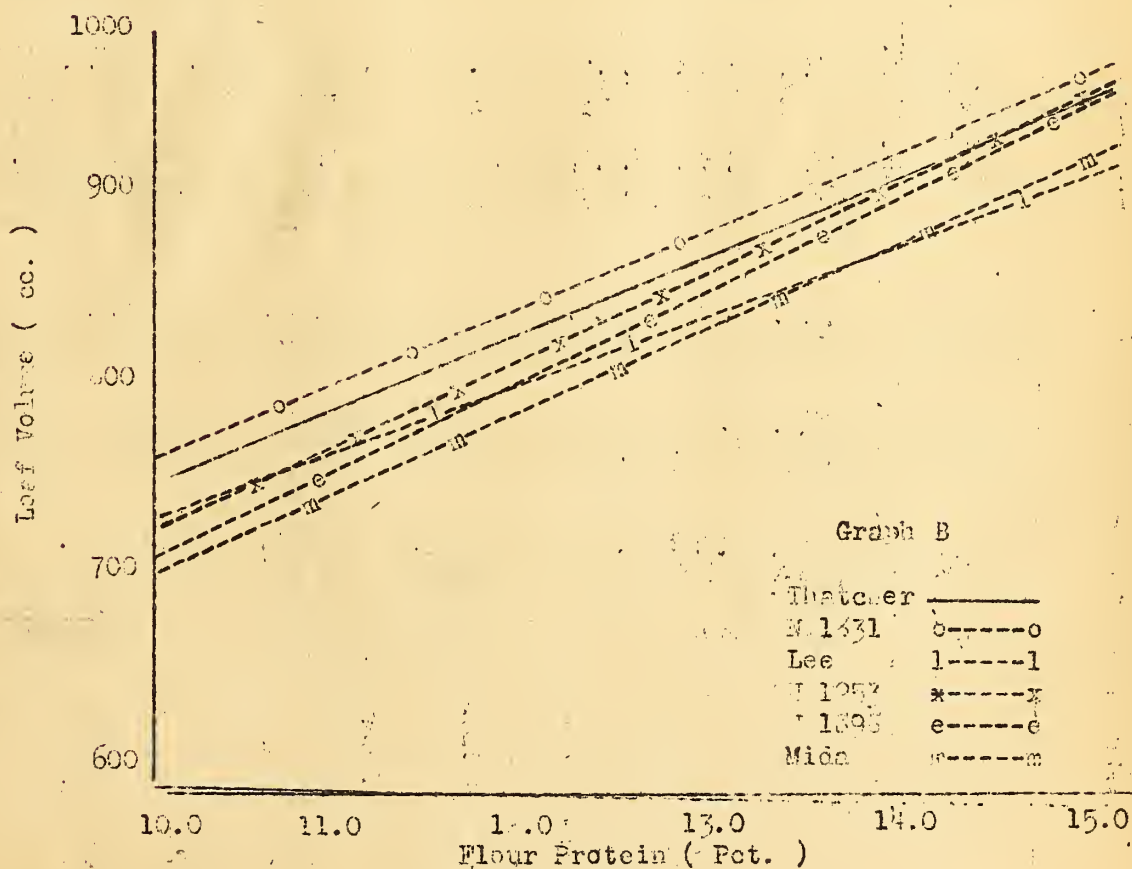
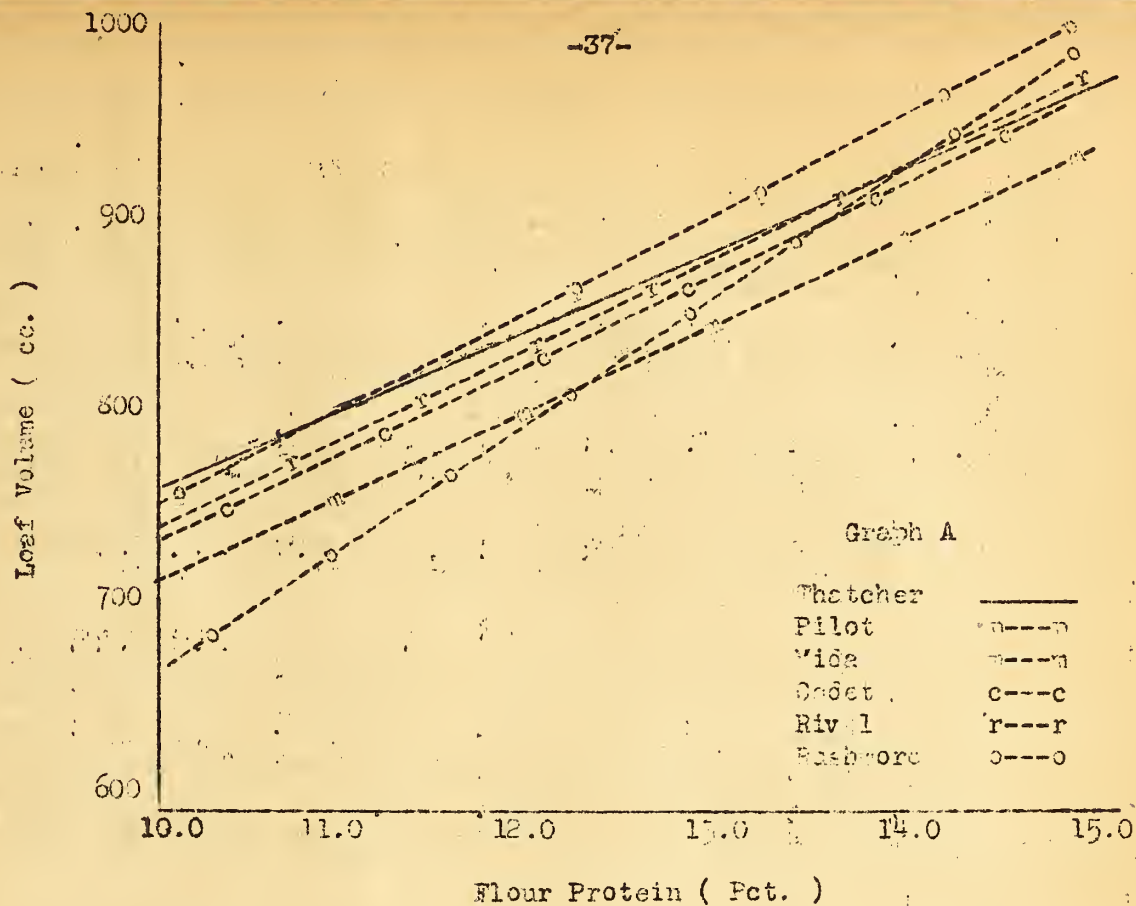


Figure 1. - Regression lines for flour protein and loaf volume for a number of hard red spring varieties and strains with Thatcher included for comparison, 1949 crop.

Table 11. Average of the milling, baking, and chemical properties of 24 wheats, the average of comparable samples of Thatcher and of each variety as shown in percentage of Thatcher, with the varieties arranged in order of percentage for optimum loaf volume in 1949.

	No. of samples	Acre yield	Test weight	Pearling Index value	Protein		Flour		Abs.	Mixing time	Opt. br.	Methods & Volume		Average	
					Wheat	Flour	Yield	Ash				No. 6	Avg. Opt.	Crumb	Grain
		Bu.	Lbs.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Min.	Mg.	Cc.	Cc.	Score	Score
NN 2797	3	20.2	54.9	26.4	16.1	15.4	71.6	60	68	2.3	2.66	1003	1061	1097	73.1
Thatcher	3	15.9	53.3	24.1	14.8	14.3	72.3	55	65	2.5	1.33	965	935	967	71
Percentage of Thatcher	127.0	103.0	109.5	108.8	107.7	107.7	99.0	109.1	104.6	92.0	200.0	103.9	113.5	113.4	102.8
Rescue	5	14.4	59.5	32.3	15.4	15.3	73.8	48	66	2.4	1.60	1022	1009	1046	77
Thatcher	5	16.5	59.2	29.1	16.0	15.8	73.2	49	68	2.4	1.20	976	951	978	74
Percentage of Thatcher	87.3	100.5	111.0	96.3	96.8	96.8	100.8	98.0	97.1	100.0	133.3	104.7	106.1	107.0	104.1
NN 2211	4	32.3	57.8	29.6	15.9	15.3	71.1	48	68	2.4	1.25	979	954	993	77
Thatcher	4	28.7	57.0	31.8	15.7	15.2	73.8	52	66	2.3	1.00	955	934	973	73
Percentage of Thatcher	112.5	101.4	93.1	101.3	100.7	96.3	96.3	92.3	103.0	104.3	125.0	102.5	102.1	102.1	105.5
NN 2237	2	28.9	59.2	47.6	16.5	15.9	71.5	43	66	1.8	1.00	991	1011	1053	82
Thatcher	2	29.4	58.3	37.2	16.0	15.3	74.6	46	66	2.5	1.50	1002	984	1036	75
Percentage of Thatcher	98.3	102.1	128.0	103.1	103.9	95.8	95.8	93.5	100.0	72.0	66.7	98.9	102.7	101.6	109.3
Redman	11	16.9	56.0	29.9	15.2	14.8	73.2	51	66	2.6	1.82	980	973	1009	82
Thatcher	11	16.1	57.2	27.0	15.6	15.1	72.8	51	66	2.5	1.18	984	958	994	75
Percentage of Thatcher	105.0	97.9	110.7	97.4	98.0	100.5	100.5	100.0	100.0	104.0	154.2	99.6	101.6	101.5	109.3
NN 2313	2	29.9	59.4	41.0	16.5	16.0	71.5	41	64	1.8	1.00	1014	1010	1037	81
Thatcher	2	29.4	58.3	37.2	16.0	15.3	74.6	46	66	2.5	1.5	1002	984	1036	75
Percentage of Thatcher	101.7	101.9	110.2	103.1	104.6	95.8	95.8	89.1	97.0	72.0	66.7	101.2	102.6	101.1	108.0
NN 2174	4	30.4	57.4	25.5	15.0	14.2	72.3	56	69	2.6	.75	970	941	972	81
Thatcher	4	28.7	57.0	31.8	15.7	15.2	73.8	52	66	2.3	1.00	955	934	973	73
Percentage of Thatcher	105.9	100.7	80.2	95.5	93.4	98.0	98.0	107.7	104.5	113.0	75.0	101.6	100.7	99.9	111.0
Cadet	18	19.4	55.6	26.2	15.0	14.6	72.1	55	68	2.6	1.44	931	921	954	81
Thatcher	18	19.7	56.9	26.6	15.3	14.8	72.9	53	66	2.5	1.17	951	924	962	74
Percentage of Thatcher	98.5	97.7	98.5	98.0	98.6	98.9	98.9	103.8	103.0	104.0	123.1	97.9	99.2	99.2	103.5
Henry	7	20.6	56.0	33.9	14.4	13.6	74.1	51	62	2.4	1.43	952	933	970	75
Thatcher	7	15.3	54.2	24.3	15.4	14.8	71.2	56	65	2.6	1.29	975	949	981	73
Percentage of Thatcher	135.9	103.3	139.5	93.5	91.9	104.1	104.1	91.1	95.4	92.3	110.9	97.6	98.3	98.9	102.7
Pilot	16	20.6	56.6	26.1	15.1	14.2	72.0	49	65	2.3	1.00	961	932	969	79
Thatcher	16	20.0	56.8	27.4	15.6	15.2	73.0	52	67	2.4	1.19	972	942	982	74
Percentage of Thatcher	104.0	99.6	95.3	96.8	93.4	98.6	98.6	94.2	97.0	95.8	84.0	98.9	98.9	98.7	106.8

Table 11. Continued

No. of samples	Acres	Test yield weight	Pearling index value	Wheat		Protein		Flour		Ash	Abs.	Mixing time	Opt. br.	Methods & Volume		Average
				Pct.	Pct.	Pct.	Pct.	Pct.	Pct.					No. 6	Avg. Co.	Crumb color
	Bu.	Lbs.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Pct.	Min.	Mg.	Co.	Co.	Score
NN 1924	4	25.3	59.9	31.6	14.3	13.7	74.5	53	67	2.4	2.00	879	878	897	76	84
Thatcher	4	27.6	59.3	27.3	15.1	14.8	72.8	54	68	2.3	1.00	911	881	911	76	83
Percentage of Thatcher	91.7	101.0	115.8	94.7	92.6	102.3	98.1	98.5	104.3	200.0	96.5	99.7	98.5	100.0	101.2	
Rushmore	10	21.6	57.2	32.3	15.0	14.5	74.8	53	65	2.8	1.10	953	928	965	79	88
Thatcher	10	19.4	55.4	27.0	15.8	15.2	72.4	56	66	2.3	1.40	977	952	988	73	85
Percentage of Thatcher	111.3	103.2	119.6	94.9	95.4	103.3	94.6	98.5	121.7	78.6	97.5	97.5	97.7	108.2	103.5	
NN 1898	13	22.1	56.8	23.1	14.9	14.1	71.4	54	69	2.8	1.08	914	895	923	81	85
Thatcher	13	21.0	56.7	26.5	15.1	14.6	72.7	53	66	2.4	1.23	944	913	951	74	84
Percentage of Thatcher	105.2	100.3	87.2	98.7	96.6	98.2	101.9	104.5	116.7	87.8	96.8	98.0	97.1	109.5	101.2	
NN 3274	6	20.9	58.4	30.2	15.0	14.4	73.3	52	68	2.3	1.17	887	875	902	81	86
Thatcher	6	18.2	57.8	25.3	14.8	14.4	72.8	52	67	2.5	.83	930	894	930	75	86
Percentage of Thatcher	114.8	101.0	119.4	101.4	100.0	100.7	100.0	101.5	92.0	141.0	95.4	97.9	97.0	108.0	100.0	
Lee	19	22.6	58.4	32.4	15.7	15.1	73.0	53	67	2.4	1.05	926	906	936	85	85
Thatcher	19	18.8	56.8	26.6	15.3	14.8	72.7	53	66	2.5	1.21	954	930	967	74	84
Percentage of Thatcher	120.2	102.8	121.8	102.6	102.0	100.4	100.0	101.5	96.0	86.8	97.1	97.4	96.8	114.9	101.2	
NN 1831	16	22.1	58.3	28.0	14.3	13.8	75.4	51	66	2.3	1.13	930	902	933	78	86
Thatcher	16	20.2	57.0	27.0	15.4	14.9	72.9	53	66	2.4	1.06	958	931	969	74	83
Percentage of Thatcher	109.4	102.3	103.7	92.9	92.6	103.4	96.2	100.0	95.8	106.6	97.1	96.9	96.3	105.4	103.6	
NN 2095	6	20.3	59.5	26.5	15.8	14.8	72.0	51	68	2.6	.67	914	900	924	83	86
Thatcher	6	23.9	57.2	30.1	15.7	15.3	73.4	51	66	2.3	1.17	952	928	967	74	85
Percentage of Thatcher	84.9	104.0	88.0	100.6	96.7	98.1	100.0	103.0	113.0	57.3	96.0	97.0	95.6	112.2	101.2	
Rival	14	20.0	58.1	27.8	14.4	13.7	74.7	58	68	2.9	1.07	908	892	918	82	87
Thatcher	14	17.1	56.7	26.3	15.2	14.7	72.7	54	66	2.5	1.21	958	931	969	74	85
Percentage of Thatcher	117.0	102.5	105.7	94.7	93.2	102.8	107.4	103.0	116.0	88.4	94.8	95.8	94.7	110.8	102.4	
NN 1953	16	22.0	60.2	28.3	14.3	13.6	73.0	46	66	2.3	1.00	902	878	906	84	85
Thatcher	16	19.2	56.9	26.9	15.4	14.9	72.9	52	66	2.4	1.19	953	924	959	74	83
Percentage of Thatcher	114.6	105.8	105.2	92.9	91.3	100.1	88.5	100.0	95.8	84.0	94.6	95.0	94.5	113.5	102.4	
NN 2083	6	24.4	60.6	30.0	13.9	13.1	73.4	52	65	1.9	1.50	849	855	875	74	85
Thatcher	6	22.3	58.9	26.7	14.8	14.3	73.4	51	66	2.3	.83	926	897	927	76	84
Percentage of Thatcher	109.4	102.9	112.4	93.9	91.6	100.0	102.0	98.5	82.6	180.7	91.7	95.3	94.4	97.4	101.2	
Mida	22	22.6	59.5	30.5	14.8	14.1	74.7	49	66	2.3	1.09	893	867	899	85	86
Thatcher	22	20.7	56.9	27.4	15.4	14.9	72.9	52	66	2.4	1.23	964	938	978	74	84
Percentage of Thatcher	109.2	104.6	111.3	96.1	94.6	102.5	94.2	100.0	95.8	88.6	92.6	92.4	91.9	114.9	102.4	

Table 12. Acre yields and total number of samples comparable with Thatcher and weighted average milling, baking, and chemical properties expressed in percentage of Thatcher for the 12 years, 1938 through 1949.

Yield Results								
Variety, state or N. No.	Years grown	Station years	Acre yield	Variety, state or N. No.	Years grown	No. of samples	Test weight	
N. No. 2233	2	2	180.0	Thatcher	12	236	Minn. 2824	104.8
N. No. 2239	2	3	162.9	Pilot	12	180	N. No. 1953	104.6
Henry	9	55	119.1	Mida	11	152	Mida	104.4
Minn. 2824	2	4	114.2	Cadet	10	150	N. No. 2095	103.4
N. No. 2083	3	11	112.2	Rival	12	143	N. No. 2083	103.1
Ns. 3274	2	8	112.1	Lee	4	60	Lee	102.1
Rushmore	8	38	110.4	N. No. 1831	5	56	Henry	101.8
N. No. 1953	4	25	110.1	Henry	8	54	N. No. 1831	101.6
Lee	4	58	109.6	Redman	4	40	Rival	101.5
Mida	11	152	109.1	Rushmore	8	38	Ns. 3274	100.9
Rival	12	143	108.4	Rescue	5	27	N. No. 2239	100.9
N. No. 2174	3	8	108.0	N. No. 1953	4	26	Rescue	100.4
N. No. 1831	6	58	107.0	N. No. 1898	4	25	N. No. 2211	100.3
N. No. 1996	2	5	106.0	N. No. 1860	7	16	N. No. 1860	100.3
Pilot	12	188	105.9	N. No. 2083	3	11	N. No. 2233	100.3
N. No. 2211	2	7	104.5	Minn. 2797	2	9	Pilot	100.3
N. No. 1898	4	25	104.4	N. No. 2095	2	9	N. No. 1996	100.2
Cadet	10	150	102.0	N. No. 2174	3	8	N. No. 1898	100.1
N. No. 1860	7	16	101.1	Ns. 3274	2	8	Redman	100.1
THATCHER	12	230	100.0	N. No. 2211	2	7	N. No. 2174	100.0
Redman	4	41	99.6	N. No. 1996	2	4	Minn. 2797	100.0
Minn. 2797	2	9	99.6	Minn. 2824	2	4	THATCHER	100.0
N. No. 2095	3	10	96.4	N. No. 2239	2	3	Rushmore	99.4
Rescue	5	27	88.1	N. No. 2233	2	2	Cadet	99.0

Quality Results

Crude protein of wheat	Flour yield	Ash of flour	Water absorption of flour
Minn. 2797	104.1	Henry	102.7
N. No. 2233	104.0	N. No. 1831	102.6
Lee	103.8	Rival	102.5
Minn. 2824	101.3	Mida	102.3
Ns. 3274	101.2	Redman	101.4
Cadet	101.0	Minn. 2824	101.3
N. No. 2211	100.7	Ns. 3274	100.9
N. No. 2095	100.2	N. No. 1996	100.7
THATCHER	100.0	N. No. 2233	100.4
N. No. 2239	99.4	N. No. 2083	100.2
Mida	99.2	Lee	100.0
Rival	98.9	THATCHER	100.0
Redman	98.3	N. No. 1953	99.9
Pilot	98.2	Rescue	99.5
Rescue	98.9	Rushmore	99.4
N. No. 1898	97.7	Cadet	99.2
N. No. 1860	97.4	N. No. 1860	99.2
Rushmore	97.1	N. No. 2174	98.9
N. No. 1953	96.0	Pilot	98.8
N. No. 2174	95.8	N. No. 2095	98.5
N. No. 2083	95.5	N. No. 1898	98.4
N. No. 1831	93.8	N. No. 2239	98.4
Henry	93.3	Minn. 2797	98.1
N. No. 1996	92.9	N. No. 2211	97.1
		N. No. 1860	114.3
		Minn. 2797	112.9
		N. No. 2174	111.3
		Rival	105.2
		Cadet	105.0
		N. No. 1898	104.7
		N. No. 2083	104.5
		N. No. 2239	102.1
		Ns. 3274	101.4
		Lee	100.7
		N. No. 2233	100.0
		THATCHER	100.0
		Rushmore	99.9
		N. No. 2211	98.8
		N. No. 1831	98.2
		N. No. 2095	97.5
		Redman	97.4
		Mida	97.0
		Pilot	97.0
		N. No. 1996	96.2
		Rescue	96.2
		Henry	93.1
		N. No. 1953	93.1
		Minn. 2824	92.7
		N. No. 1860	106.2
		Minn. 2797	105.6
		N. No. 1898	105.3
		Cadet	104.3
		Rival	103.1
		N. No. 2095	103.0
		N. No. 2211	103.0
		Lee	102.5
		N. No. 2233	101.5
		N. No. 2239	101.5
		Ns. 3274	101.1
		N. No. 2174	100.7
		N. No. 1831	100.5
		Mida	100.4
		Redman	100.1
		N. No. 1996	100.0
		THATCHER	100.0
		N. No. 1953	99.7
		Rushmore	99.6
		N. No. 2083	99.2
		Pilot	98.5
		Rescue	98.0
		Henry	97.3
		Minn. 2824	95.5

Table 12.—Continued

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Quality Results

<u>Loaf Volume</u> <u>Method No. 6</u>		<u>Loaf Volume</u> <u>Average</u>		<u>Loaf Volume</u> <u>Optimum</u>	
Minn. 2797	103.4	Minn. 2797	105.5	Minn. 2797	106.6
Rescue	102.4	Rescue	102.5	Rescue	103.2
N. No. 2211	100.9	N. No. 2233	102.3	N. No. 2233	102.3
N. No. 2174	100.5	N. No. 2211	101.5	N. No. 2211	100.7
Cadet	100.4	Cadet	100.4	Cadet	100.6
THATCHER	100.0	N. No. 1996	100.3	Redman	100.4
Lee	99.8	Minn. 2824	100.3	THATCHER	100.0
Redman	99.7	Lee	100.1	Lee	99.8
Rushmore	99.4	Redman	100.0	Pilot	99.2
Pilot	99.1	N. No. 1831	100.0	N. No. 1860	99.2
N. No. 1996	99.1	THATCHER	100.0	N. No. 2174	99.1
Rival	98.4	Pilot	99.7	Minn. 2824	99.0
N. No. 1831	98.3	N. No. 1860	99.5	Rushmore	98.9
Minn. 2824	98.3	N. No. 2174	99.0	N. No. 1996	98.7
N. No. 1898	98.0	Rushmore	98.9	N. No. 1831	98.6
N. No. 2083	97.6	N. No. 1898	98.4	Rival	98.1
N. No. 2233	97.6	Rival	98.1	Ns. 3274	97.5
N. No. 1953	96.8	Ns. 3274	98.1	N. No. 2239	97.2
N. No. 2095	96.8	N. No. 2239	97.2	N. No. 2083	96.9
Henry	96.4	N. No. 2095	97.0	Henry	96.8
Ns. 3274	96.3	N. No. 2083	97.0	N. No. 1953	96.3
N. No. 1860	95.7	Henry	96.8	N. No. 1898	95.7
Mida	95.5	N. No. 1953	96.1	N. No. 2095	95.6
N. No. 2239	92.0	Mida	94.9	Mida	94.8

Quality Results

<u>Crumb Color</u> <u>Average</u>		<u>Grain - Texture</u> <u>Average</u>		<u>Summary of all tests</u> <u>for 7 properties</u> ^{1/}	
N. No. 2095	114.3	Redman	104.4	Lee	103.3
Lee	113.1	N. No. 2239	102.4	Minn. 2797	102.8
Mida	109.6	Minn. 2824	102.3	N. No. 2095	102.4
N. No. 1953	107.7	Cadet	102.0	Cadet	101.9
Cadet	107.5	N. No. 2095	101.9	Mida	101.8
N. No. 1898	107.2	Mida	101.7	Redman	101.6
Redman	106.8	Lee	101.6	Rival	101.4
N. No. 1996	106.8	Ns. 3274	101.5	Ns. 3274	101.4
N. No. 2174	106.5	N. No. 1831	101.4	N. No. 1860	100.9
Ns. 3274	106.5	Pilot	101.3	N. No. 2233	100.8
N. No. 2239	105.5	Rival	101.1	N. No. 2239	100.8
Minn. 2797	105.4	N. No. 1953	101.0	N. No. 1953	100.7
Rival	104.3	Rushmore	100.0	N. No. 1898	100.6
Pilot	104.0	Minn. 2797	100.0	N. No. 2211	100.4
N. No. 1831	103.8	N. No. 2174	100.0	N. No. 1831	100.3
N. No. 1860	103.8	N. No. 2211	100.0	N. No. 2174	100.1
N. No. 2233	101.3	N. No. 1860	100.0	Pilot	100.0
N. No. 2211	101.3	N. No. 1996	100.0	THATCHER	100.0
Rushmore	101.0	THATCHER	100.0	N. No. 1996	99.9
THATCHER	100.0	N. No. 2083	99.9	Rescue	99.7
Rescue	99.4	N. No. 1898	99.5	Minn. 2824	99.5
N. No. 2083	94.9	Rescue	99.4	Rushmore	99.3
Henry	94.2	Henry	97.8	N. No. 2083	98.5
Minn. 2824	92.3	N. No. 2233	95.5	Henry	97.7

^{1/}Test weight, wheat protein, flour yield, water absorption, optimum loaf volume, crumb color and grain texture.

SUMMARY: COMPARABLE SAMPLES 1949

In table 11, the properties of the 1949 samples of 24 varieties or strains of hard red spring wheat are compared with those of Thatcher grown in the same tests. The varieties are arranged in order of the optimum loaf volume expressed as a percentage of Thatcher.

SUMMARY: COMPARABLE SAMPLES 1938 TO 1949

Table 12 gives the averages (2 to 12 years) of the milling, baking, and chemical properties of 24 varieties and strains, expressed as a percentage of comparable samples of Thatcher. These include the leading commercial varieties grown in the region and the most promising new hybrid strains that have been tested. The total number of samples tested of each variety or strain varied from 2 to 236. The more important quality comparisons for only the numbered hybrid strains, (in the summary table 12) will be discussed in relation to Thatcher as 100 percent. The named varieties in table 12 have been discussed previously in the 1946 and 1947 reports. The strains are listed in order of the total number of samples tested.

N. NO. 1831

N. No. 1831 is Mida X Cadet (C. I. 12363). It was tested in the Uniform Regional Nursery during the 3 years 1945 to 1949 and because of its high yield and quality was advanced to plot experiments and made a uniform variety in 1948. It is beardless and a rather late, tall wheat.

During the last 5 years, 56 milling and baking tests show N. No. 1831 to exceed Thatcher in test weight, flour yield, water absorption of flour, crumb color, and grain texture. It has been among one of the better wheats in yield of flour ranking 2nd among the 24 varieties and strains compared. Due partly to its high yield, it has averaged lower in wheat protein (1.0 percent) than Thatcher. The protein content has been consistently low during the years tested. It averages also lower in flour ash, and loaf volume by the optimum, and No. 6 methods. The loaf volumes, although lower than Thatcher, are better than expected on the basis of its protein content.

It has been uniformly good in grain texture and crumb color in all years tested. N. No. 1831 has good milling characteristics and produces a granular flour similar in this respect to the flour from Thatcher. It averaged about the same as Thatcher in dough mixing time but required about 25 percent greater amounts of oxidizing agents than Thatcher for optimum bread. N. No. 1831 averages 15th in the summary of seven principal properties among the 24 wheats compared.

N. NO. 1953

N. No. 1953 is Pilot X Mida (C. I. 12445). It has been in the Uniform Regional Nursery for 3 years where it has been a high yielding, heavy test weight wheat. It is bearded, resistant to loose smut, and is a good dry land wheat, best adapted for the Western section of the region.

During a 4-year period, 24 comparable milling and baking tests show it to exceed Thatcher with respect to test weight, grain texture and crumb color. N. No. 1953 is similar to Thatcher in hardness, according the pearling index values. It has good milling characteristics but yields slightly less flour than expected considering its high test weight. It averages lower in protein content and loaf volume than Thatcher. The protein content, averaging 0.6 percent lower in the wheat than Thatcher, is due largely to higher acre yields. It averages lower in ash content of flour than either Thatcher or Mida. It has about the same dough mixing time, is equal in water absorption, but requires slightly lower amounts of oxidizing agents than Thatcher for optimum bread. It has been outstanding as to test weight and crumb color of bread for each of the 4 years tested. It ranks 12th for the average of seven principal properties among the 24 wheats (table 12) compared.

N. NO. 1898

N. No. 1898 is Pilot X Merit (C. I. 12442). It was in the Uniform Regional Nursery for the 3-year period 1946 to 1948, ranking second for yield during that period. It also averaged high in loaf volume and other quality properties. It is bearded, resistant to scab, and best adapted for the Eastern section of the region.

The weighted average of 25 comparable samples for 4 years show N. No. 1898 to exceed Thatcher with respect to water absorption of flour and crumb color of bread. It has been one of the better strains in crumb color among the varieties compared, averaging uniformly good in all of the years tested. It has averaged lower in protein content of wheat (0.4 percent), yield of flour, loaf volume of the No. 6; average and optimum bake, and grain texture than Thatcher. In test weight per bushel, it is equal to Thatcher.

The quality of the gluten of N. No. 1898 is good. The loaf volume, although lower than Thatcher but higher than Mida, is better than expected on the basis of its protein content. N. No. 1898 averaged third highest in water absorption and was among those highest in ash content of flour ranking 6th of the 24 varieties and strains compared. It mills satisfactorily. The grain of N. No. 1898 was found to be slightly harder than that of Thatcher according to the pearling index value. It has a longer dough mixing time and requires about 25 percent greater amounts of oxidizing agents than Thatcher for optimum bread. N. No. 1898 averages 13th in the summary of seven principal properties among the 24 wheats (table 12) compared.

N. NO. 1860

N. No. 1860 is Merit X Pilot (C. I. 12355). It was included in the Uniform Regional Nursery for the 3-year period 1944 to 1946 by the Montana Station and has been continued among the plot varieties at Stations in that state.

The weighted average of 16 milling and baking tests for 7 years show N. No. 1860 to exceed Thatcher with respect to water absorption of flour and crumb color of bread. It has been one of the best strains in water absorption among the 24 wheats compared, averaging highest for the years tested. N. No. 1860 averaged about the same as Thatcher in test weight per bushel, flour yield, loaf volume of bread (average and optimum) and grain texture. The ash content of the flour of N. No. 1860 has been high and averaged 1st among the 24 wheats compared in this report.

It averaged slightly lower in protein content of wheat (0.4 percent) than Thatcher. The quality of the gluten appears to be good with satisfactory dough-handling properties in the bake shop. It has averaged higher than Mida and Rival in optimum loaf volume. It mills satisfactorily, producing a granular flour similar in this respect to the flour from Thatcher. The grain of N. No. 1860 was found to be slightly harder than that of Thatcher according to the pearling-index value. It has the same dough mixing time and requires about twice the amount of bromate than Thatcher for the best bread. N. No. 1860 averages 9th in the summary of seven principal properties among the 24 wheats (table 12) compared.

N. NO. 2083

N. No. 2083 is 1552 X Mida (C. I. 12543). It was developed at the Dickinson, North Dakota Station and was entered in the Uniform Regional Nursery in 1948. It has been grown in plot experiments at the Dickinson Station for 2 years where it has yielded over 8 percent more than Thatcher.

The weighted average of 11 comparable samples for 3 years showed that N. No. 2083 exceeded Thatcher with respect to test weight per bushel but that it was about the same as Thatcher in yield of flour, water absorption, and grain texture of bread. It has averaged 0.7 percent lower in protein content of wheat than Thatcher, probably due in part to its higher acre yields. It has been uniformly low in all comparable tests with Thatcher and ranks 21st in protein content among 24 wheats compared in table 12. N. No. 2083 has good milling characteristics. The grain of N. No. 2083 is slightly softer than that of Thatcher according to the higher pearling index values. It exceeds Thatcher in ash content of flour, ranking 7th among 24 wheats compared. In the bread baking tests N. No. 2083 has ranked inferior to Thatcher, averaging lower in loaf volume by the three methods (No. 6 average and optimum) and crumb color. It ranks 19th by the optimum bread baking method among 24 wheats compared. It has a slightly shorter dough-mixing time but required about 50 percent greater amounts of oxidation agents for the best bread than that of Thatcher. N. No. 2083 ranked 23rd (only Henry was lower) in the summary of seven principal properties.

MINN. 2797

Minn. 2797 is Tinstein X Newthatch II-42-22 (C. I. 12634). It was developed at the St. Paul, Minnesota Station and included in the Uniform Regional Nursery in 1948. There it ranked 25th for yield among the 26 wheats so was not continued, except in plots at the Minnesota Station. It has excellent leaf rust resistance and because of its good quality is being used in breeding.

Nine samples of Minn. 2797 tested during the 2-year period shows it to exceed Thatcher with respect to water absorption of flour, loaf volume of bread by all methods, and crumb color of bread. It has been one of the better strains in protein averaging 0.6 percent higher than Thatcher. In flour ash, it averaged .07 percent higher than Thatcher. In loaf volume of bread by three methods and protein content it has ranked 1st among the 24 wheats compared. Minn. 2797 has satisfactory milling characteristics but produces about 2.0 percent less flour than Thatcher. The grain of Minn. 2797 has about the same pearling index value as Thatcher indicating that it is similar to Thatcher in hardness and produces a

granular flour. It is about the same as Thatcher in test weight per bushel, and grain texture of bread. The dough-mixing time was about the same, but the bromate requirements were slightly higher than for Thatcher. Milling and baking tests have shown Minn. 2797 to be one of the better strains, ranking 2nd for the average of seven principal properties among the 24 wheats compared.

N. NO. 2095

N. No. 2095 is 1750X1753 (C. I. 12551). It was a high quality wheat in the Langdon Station nursery in 1947 and in Sheridan plot experiments in 1948. Because of its good quality it was included in the Uniform Regional Nursery in 1949 but ranked 24th for yield among the 26 wheats grown.

During the three year period 9 comparable milling and baking tests show N. No. 2095 to exceed Thatcher with respect to test weight per bushel, water absorption of flour, crumb color, and grain texture of bread. It is one of the better strains, ranking 4th in test weight per bushel, 1st in crumb color, and 5th in grain-texture among 24 wheats compared. It averaged about the same in protein content but was lower in flour ash than Thatcher. It has generally milled satisfactorily, with only two samples questionable of the 9 tested. The pearling-index values show the grain of N. No. 2095 to be similar in hardness to that of Thatcher but yielded a slightly lower percentage of flour. N. No. 2095 has about the same dough-mixing time but requires about 25 percent less potassium bromate (the oxidizing agent used in these bread tests) than Thatcher for optimum bread. It averaged lower in loaf volume by all of the bread tests than Thatcher, ranking 23rd in the optimum bake (considered in these studies to be the better of the methods used) of the 24 varieties and strains compared. It is an outstanding strain in crumb color being similar to Lee and Hida in this respect and averages 3rd in the summary of seven principal properties among 24 wheats compared.

N. NO. 2174

N. No. 2174 is Pilot² X Merit (C. I. 12732). It was the highest quality wheat in the Langdon Station nursery in 1947, and did well in yield and quality tests of other Stations in 1948. It was advanced to the Uniform Regional nursery in 1948 and to plot experiments in 1949 and 1950.

N. No. 2174 has been in nursery and plot experiments for three years where 8 samples have been grown under comparable conditions with Thatcher. These tests show N. No. 2174 to average about the same as Thatcher in water absorption of flour, test weight per bushel, flour yield, and grain-texture of bread. It has been one of the highest in flour ash, ranking 3rd among the 24 wheats compared in table 12. The grain of N. No. 2174 has generally milled satisfactorily although it is, according to the pearling index values, somewhat harder in texture (about 20 percent) than comparable samples of Thatcher. It averaged 0.6 percent lower in wheat protein than Thatcher, probably due to its higher acre yields. It ranks 20th in wheat protein among the 24 wheats. The loaf volumes of the bread by the various methods show that N. No. 2174 is about equal to the loaf volumes obtained from Thatcher. This indicates that the quality of the gluten is perhaps better than expected according to its protein content. N. No. 2174 has a slightly longer dough mixing time and requires approximately 30 percent less of potassium bromate than Thatcher

for optimum bread. It was one of the better strains in crumb color of bread, ranking 9th among 24 wheats compared in table 12. In the summary of seven principal properties, it ranked 16th among the 24 wheats.

NS. 3274

Ns. 3274 is 2744X2809 (C. I. 12643), a strain from the same cross as Mida, developed at the Fargo, North Dakota, Station. It was included in the Uniform Regional Nursery in 1948. During the 2 years it ranked 7th for yield among 13 wheats tested during the period. It is more resistant to loose smut than Mida but shatters about the same.

During the two-year period, 8 comparable milling and baking tests showed that Ns. 3274 exceeded Thatcher with respect to test weight per bushel; protein content of wheat (0.2 of a percent), flour yield, water absorption of flour, and crumb color and grain texture of bread. It has been one of the better strains, ranking 5th in protein content of wheat, 7th in flour yield, and 10th in crumb color of bread among the 24 wheats compared in table 12. Ns. 3274 has good milling characteristics and produces a slightly higher percentage of flour than Thatcher. The grain of Ns. 3274 was found to have a higher pearling-index value, indicating that it is slightly softer in texture than Thatcher. It exceeds Thatcher in ash content of flour, ranking 9th among 24 wheats compared in table 12. The dough-mixing time was about 10 percent shorter, but the bromate requirements for optimum bread were only slightly higher than Thatcher. Ns. 3274 has averaged slightly lower in loaf volume of bread (No. 6, average, optimum methods) than Thatcher. It averages 8th in the summary of seven principal properties among 24 wheats (table 12) compared.

N. NO. 2211

N. No. 2211 is 1764 X Henry (C. I. 12733). It was included in the Uniform Regional Nursery for the first time in 1949, after showing good quality results in the Langdon and Mandan Station Nurseries in 1948. It is a very early wheat, is bearded and has moderate resistance to leaf rust.

The weighted average of seven comparable samples for 2 years shows that N. No. 2211 has exceeded Thatcher in test weight per bushel, protein content of wheat, water absorption of flour, loaf volume of bread (No. 6, average and optimum methods) and crumb color of bread. It has been one of the better strains in water absorption of flour and optimum loaf volume of bread, ranking 7th and 4th, respectively, among 24 wheats compared. N. No. 2211 averaged about 3.0 percent lower in flour yield than Thatcher and ranked lowest in this property among the 24 wheats compared in table 12. The grain of N. No. 2211 has been found to have a lower pearling-index value, indicating that it is harder in texture than Thatcher. Most samples of it have generally milled satisfactorily but some have shown a tendency for the middlings to be difficult to reduce to flour. Other years' tests showed that N. No. 1764, one of the parents in the cross, was hard and vitreous, and milled with difficulty, being extremely hard to reduce or grind. N. No. 2211 has averaged about the same as Thatcher in flour ash, dough-mixing time, grain texture of bread and oxidation requirements for optimum bread.

It averages 14th in the summary of seven principal properties among 24 wheats compared in table 12.

N. No. 1996

N. No. 1996 is Pilot X Merit (C. I. 12648). It was included in the Uniform Regional Nursery for the first time in 1949 and sponsored by the Montana Station. It is bearded and has had a good performance in the Montana Intrastate Nursery.

The weighted average of 4 comparable samples for 2 years shows N. No. 1996 to be about the same as Thatcher in test weight per bushel, flour yield, water absorption of flour, and grain texture of bread. N. No. 1996 has good milling characteristics and produces a granular flour similar in this respect to the flour from Thatcher. Protein tests of N. No. 1996 have shown it to average 1.1 percent lower in the wheat in comparison with comparably grown samples of Thatcher. It ranks lowest in wheat protein content among the 24 wheats compared in table 12. The quality of the gluten is good, producing bread that has an optimum loaf volume nearly as good as some of the much higher protein varieties. N. No. 1996 averages slightly lower in loaf volume of the optimum bake, but is better in crumb color of bread than Thatcher. It requires about a 25 percent longer dough-mixing time and nearly three times the amount of oxidizing agents than Thatcher for optimum bread. N. No. 1996 is one of the better strains in flour ash, being lower than Thatcher and ranking 20th among 24 wheats compared. It has been one of the better wheats in crumb color of bread, ranking 8th while in the summary of seven principal properties it ranks 19th among 24 wheats.

MINN. 2824

Minn. 2824 is Thatcher X Surpresa II-39-8 (C. I. 12641). It was developed at and included in the Uniform Regional Nursery by the St. Paul, Minnesota, Station in 1948. Two years' tests in the Regional Nursery have shown it to have good leaf rust resistance and high yield.

The four samples of Minn. 2824, grown for 2 years in the nursery trials show it has exceeded Thatcher in test weight per bushel, protein content of wheat [(0.2 of a pct.)] and flour [(0.3 of a pct.)], flour yield, and grain texture of bread. The grain of Minn. 2824 is slightly softer in texture, according to the higher pearling-index value than Thatcher but it milled satisfactorily and produced a granular type of flour. It is one of the better wheats in test weight per bushel, ranking 1st, and in protein content of wheat, ranking 4th among 24 varieties and crosses compared. It is outstanding in ash content of flour, averaging lower than Thatcher and it ranks lowest among the wheats compared. Minn. 2824 averages lower in water absorption of flour, has a shorter dough mixing time (about 40 percent) but requires about twice the amount of oxidizing agents for optimum bread than Thatcher. The bread loaf volume of Minn. 2824 averages about the same as the volume of the bread from Thatcher. It is lowest in crumb color of bread of the 24 wheats, averaging 92.3 percent of the crumb color of the bread from Thatcher. Minn. 2824 averaged lowest in water absorption of flour, 6th in flour yield, being one of the better strains in this respect, and 21st for the summary of seven principal properties among 24 wheats compared.

N. NO. 2239

N. No. 2239 is Henry X Cadet (C. I. 12779) and was developed at Langdon, North Dakota. It was the highest yielding wheat among 12 Arizona increases grown in single plots at Langdon in 1949. It is resistant to leaf and stem rust and a candidate for the 1950 Uniform Regional Nursery, sponsored by the Wisconsin State

During the 2-year period, 3 comparable milling and baking tests show that N. No. 2239 exceeded Thatcher with respect to test weight per bushel, water absorption of flour, crumb color and grain texture of bread. It is one of the better wheats in grain texture of bread, ranking 2nd among 24 wheats compared in table 12. It milled satisfactorily but yields slightly less flour than Thatcher. The grain of N. No. 2239 was found to be similar in hardness and produced a granular type of flour like that milled from Thatcher. It averaged about the same in wheat and flour protein but slightly higher in ash content of flour than Thatcher. The dough-mixing time was the same but it required 30 percent greater amounts of oxidizing agents than Thatcher for optimum bread. N. No. 2239 averaged lower in loaf volume (about 3.0 percent) by the average and optimum methods than Thatcher, ranking 18th and 19th, respectively, among the 24 wheats compared (table 12). In the summary of seven principal properties it ranked 11th among 24 wheats compared.

N. NO. 2233

N. No. 2233 is Henry X Cadet (C. I. 12781), also developed at the Langdon, North Dakota Station. Among the 12 Arizona increases it had the highest protein content and 2nd highest loaf volume. As it was also resistant to leaf and stem rust it was a candidate for the 1950 Uniform Regional Nursery from Langdon.

Only two samples of N. No. 2233, one each in 1948 and 1949, have been milled and baked for quality evaluation. It has exceeded Thatcher in test weight per bushel, protein content of wheat [(0.6 of a pct.)] and flour, water absorption of flour, loaf volume by the average and optimum methods, and crumb color of bread.

The grain of N. No. 2233 has a slightly higher pearling-index value than Thatcher indicating that it is possibly softer in texture. It milled well, however, and required no special treatment other than that used with the acceptable varieties. Additional milling tests will be made to determine more fully the milling properties of N. No. 2233. It averaged the same in ash content of flour and dough-mixing time but required about 25 percent greater amounts of oxidizing agents for optimum bread than Thatcher. It averaged lower in grain texture of bread than Thatcher. N. No. 2233 has been one of the better strains in protein content, averaging 0.6 percent higher in the wheat and 0.7 percent higher in the flour than Thatcher. It ranked 2nd in wheat protein content and 10th in the summary of seven principal properties among the 24 wheats compared in table 12.



